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1145

United States
 Circuit Court of Appeals
 For the Ninth Circuit 1143

Transcript of Record /

GEORGE J. HENRY, Jr.,
Complainant.

vs.

CITY OF LOS ANGELES,
Defendant.

VOLUME 5
 (Pages 1601 to 2000 Inclusive)

Upon Appeal from the United States District Court for
 the Southern District of California,
 Southern Division

FILED

JAN 4 - 1918

A. Yes sir. If they stayed in the needleseats it would interfere with the closing of the needles just the same.

Q. 351. But it would not interfere with shutting down the wheel?

A. No sir; when the water is turned out at the main gate it would not.

Q. 352. So, even if the obstructions should remain in the seats, that is, such small things as could come through a 1-inch mesh, they would not interfere with the governing action of the main needle or auxiliary needle under ordinary conditions?

A. While the plant was operating?

Q. 353. Yes; while the plant was operating.

A. Yes sir; they will interfere a little in this way. If they happen to get in under the needle and should stick, it throws the stream off of the needle and does not give it a chance to divide equally in the buckets to get the true efficiency of the wheel.

Q. 354. But it would not interfere with the governing action on the needles?

A. No sir.

Q. 355. It would only act to split up the stream in its projection on the wheel?

A. Yes sir.

Q. 356. The apparatus of Division Creek No. 2 plant has been adjusted by others than yourself during the time of your connection with it, hasn't it?

A. I can't answer that. I don't know. I never have seen it. If it has been, I never saw them do it.

Q. 357. Haven't there been other people there

in connection with the aqueduct department who have overhauled these plants or inspected them as to little details at times?

A. No sir; the only overhauling—well, if they had, it has been without my knowledge of its being done at all.

Q. 358. And there were about five months in 1913 that you were away from the plant?

A. Yes sir.

Q. 359. And you don't know what was done with reference to any adjustments during that period?

A. No sir.

Q. 360. And as a matter of fact during that period the auxiliary valve might have been adjusted without your knowledge after the heavy service of the dredge operated in part or whole by the power from Division Creek No. 2 plant was terminated. Is that not correct? That is, so far as you know.

A. Yes; but there was no one there at the time but the watchman, and I don't think he would touch them.

Q. 361. I mean it might have taken place during the months that you were away?

A. It might have been.

July 12 o'clock
~~June~~ 2, 1914, R. M.

MICHAEL KVAPISHEVSKI, heretofore sworn and examined, was recalled on behalf of defendant, and testified as follows:

DIRECT EXAMINATION

By Mr. Westall:

Q. 21. You have heretofore furnished translations in this case of Defendant's Exhibit French Patent and Defendant's Exhibit Swiss Patent, have you not?

Mr. Blakeslee: We repeat our objections heretofore made with respect to both of these exhibits, on the ground that the objections heretofore registered, including the grounds that the exhibits are not identified, and that one or both of same does not come within the answer of defendant interposed in this case; that these exhibits have not been proven for use in this case. We further object to the questions put to this witness in connection with these exhibits on the ground that the witness is not qualified.

A. Yes, sir.

Q. 22. By Mr. Westall: I now call your attention to certain writings on a drawing accompanying Defendant's Exhibit French Patent, which, at the time of furnishing the translations referred to, was not apparently taken into consideration by you. Will you now please examine the writing referred to on the drawing accompanying the French Patent and furnish a translation thereof, if you understand the language in which it is written and if you are able to do so.

Mr. Blakeslee: Objected to as not the proper method of proof and not the best evidence, no foundation laid for secondary evidence, and on the

further repeated objection that the witness is not qualified, and the former objections made are, of course, repeated throughout this inquiry.

A. Referring to the inscription on the upper left hand corner of the drawing accompanying the French Patent, I find the inscription as translated would read: "Drawing adjoined to patent of 15 years taken the 8th of August, 1899, by the machine factory of Escher, Wyss & Company, incorporated. Paris the 9th of February, 1914. General Secretary of the National Office of Industrial property." The signature appears to be "Broan", but not sufficiently legible to be determined.

The inscription on the lower left hand corner reads as follows in translation: "Paris the 8th of August, 1899. By permission of the machine factory of Escher, Wyss & Company, incorporated." The part first referred to has the red letters in part.

Q. 23. By Mr. Westall: Please examine the impression of the seal partly covering the printed stamp in red.

Mr. Blakeslee: The same objection.

A. The adjoined seal, as far as can be read, shows an impression of the seal of the National Office of Industrial property.

Q. 24. By Mr. Westall: Referring to the seal at the end of the written copy of Defendant's Exhibit French Patent, will you please translate as well as you are able to make out the words of that impression of the seal?

Mr. Blakeslee: The same objection.

A. As far as I can make out, the impression of the adjoined seal reads: "National Office of Industrial Property", and on the right hand side of the margin I find the words, "Fine Arts and Trades."

Mr. Blakeslee: We repeat our objections, even in view of the testimony just taken, which have heretofore been urged with respect to the want of identification of this exhibit, no proof having been adduced as to the authenticity of the purported patent copy or the purported authentication thereof by any consular officer or other official empowered and required to authenticate documents from a source foreign to the United States and its territory.

Mr. Westall: This closes the defendant's case.

PROCEEDINGS IN REBUTTAL

Los Angeles, Cal., February 17, 1915, P. M.

W. W. WILSON, a witness produced on behalf of complainant, being first duly sworn according to law to testify the truth, the whole truth and nothing but the truth, testified as follows, in answer to interrogatories propounded by Mr. Blakeslee:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 1. Please state your full name, age, residence and occupation.

A. William Webster Wilson; age, thirty-two years; residence, 1339 Fifth Avenue, Los Angeles, California; occupation, vice-president Wilson & Willard Manufacturing Company of this city.

Q. 2. What is the nature of the business of that company?

A. General machine work and manufacturing of oil well tools and machinery.

Q. 3. What is the general nature of your occupation and connection with that company's business?

A. I have charge of the shops and office of that company.

Q. 4. How long have you attended to this kind of work for that company?

A. Since somewhere in the year 1912.

Q. 5. How long have you been engaged in mechanical pursuits?

A. Since I was about fifteen years old.

Q. 6. Have you had any academic training in this direction, and, if so, what?

A. Yes, sir; I am a graduate of the electrical engineering department of Stanford University, graduating in the fall of 1907.

Q. 7. Did you take any other courses at that University or elsewhere, or any collateral courses?

A. Collateral with the electrical engineering course I took nearly all of the other courses in the mechanical engineering department.

Q. 8. Have you ever had any experience in electrical engineering since your said academic training?

A. Yes, sir.

Q. 9. When and where?

A. In consultation on different plants in different parts of the country. One that I remember right

now, is at Topliff Rock Quarry plant of the American Smelting & Refining Company at Salt Lake City, Utah. Also, in the year 1908, for about six or seven months, from about March until August, I had charge of the Coalinga Light & Power Company at the city of Coalinga, California.

Q. 10. Have you done any other engineering work in any capacity at any other places or plants or installations than those mentioned, and, if so, when and where?

A. Yes, sir; during the spring and summer of 1906, and from about April to September, I was employed in the Bakersfield Power, Transit & Light Company power house, at the mouth of the Kern River Canyon, about 16 miles from Bakersfield, California, in the capacity of assistant, and later on on the switchboard of that company.

Q. 11. Do you know of any other name by which that plant went?

A. The only other name that I know of is the name of the company which installed the plant, which name was "The Power Development Company."

Q. 12. During the time you were employed at that plant in 1906 what territory was served by the output of the station?

Mr. Westall: Objected to on the ground that it has not been shown by his connection with the company that he is competent to testify as to the territory served.

Mr. Blakeslee: Just add on to the question "if you know."

A. The power generated there was transmitted to a sub-station at Bakersfield from which power was distributed to the city of Bakersfield and to pumping plants in the vicinity of Stockdale, which, I believe, is east of Bakersfield, and where considerable irrigating and pumping machinery was installed, and also to a flouring mill near Bakersfield where a synchronous motor was installed. These I have seen at different times while in and near the city of Bakersfield.

Q. 13. What kind of loads did you have on the circuit from that station during the time you were connected with it?

A. It had the lighting load of the city of Bakersfield, the street lights of the city of Bakersfield, the electric railway company was served through a rotary generator, the synchronous motor at the flouring mill and numerous irrigating pumps throughout the country, which, for the most part, were served through a no-voltage release switches.

Q. 14. Can you state briefly the nature of make-up of the installation at that Power Development Company plant during the time you were connected with it?

A. About a mile up the river water was taken out of the river and passed through the head gates into a tunnel through which it traveled to the forebay which was some four or five hundred feet from the power house. In this forebay the surplus water ran over a spillway and out over a waterfall back to the river. The remainder of the water passed through

baffle boards to the penstock down to the powerhouse. This pipe curved in its descent and passed along the side of the power house, and from it branches were taken off to the three water wheels. These branches passed through a gate-valve and then passed a butterfly valve to the nozzle-block inside of the wheel casing. Inside of the wheel casing also was a water wheel with the buckets cast integrally with the wheel. On this shaft and the end of the shaft was a fly-wheel arrangement with parts on it which had evidently been used for a governor at one time, but it was not in service when I was at the plant. They had arranged by placing fibre discs between the parts, bolting them together, to reduce this to a simple coupling. Beyond this was a rotating armature-type General Electric Company generator of, I believe, 16 poles. This generated alternating current at 500 volts pressure, which was led through a switchboard to the transformers where it was stepped up to 10,000 volts and passed through a high-tension switchboard to the lines. Between the three water-wheel and generator units were two other units consisting of a Pelton wheel—the other wheel I have forgotten the make of—which operated the excitors for exciting the generators for generating the current in the large generator.

Q. 15. Have you anything further to say as to the types or makes of the water-wheels at this plant at that time?

A. The water-wheels at this plant at that time were Knight wheels, made by a Mr. Knight of Sutter

County. At least that was on the name plates on the machines.

Q. 16. What if any type or kind of governing apparatus was employed at this plant at the time you were connected with it for regulating the action of the water-wheels?

A. There was no governing apparatus employed in this plant when I was there. The governing was altogether by manual operation.

Q. 17. And how was this manual operation in governing perfected?

A. Each generator had mounted on its base a Schaffer-Buttenberg tachometer which indicated the speed that the generators were running. When the speed accelerated the assistant would go to the hand wheels and close the water off slightly on the wheels until the system was brought back to the proper position. As the speed decreased the butterfly valves were opened slightly by means of the hand wheel. In case of a sudden load throw-off or let-up on the load, both parties, the assistant and the switchboard man, would run to the hand wheels and close down the generators. Or, in case of a short circuit on the line or sudden release on the load, a hydraulic apparatus was used which consisted of hydraulic valves on what we term a hydraulic board placed by the side of the electric switchboard. This board had five handles, one of which was a master handle which would close all three of the gate-valves through which the water passed to the large generators. Also, another handle was placed so as

to open the by-pass which consisted of a 12-inch pipe leading out of the side of the penstock at the side of the power house and pointing toward the river, this being a drain for the purpose of relieving a water-ram when the other valves were closed suddenly. The other three handles on the hydraulic board operated respectively the three gate-valves on the water-wheels.

Q. 18. You have mentioned a by-pass in your last answer. Was there any other by-pass than that you have mentioned in or a part of or operating in connection with this Power Development Company plant during the time you were connected with it?

A. No, sir.

Q. 19. I show you what purports to be a photograph and ask you if you know anything about it, whatsoever.

A. This is a photograph taken by Mr. A. G. Carpenter who was the foreman of the plant and who gave the same to me, and it has been in my possession ever since. He gave this to me while I was working at the Power Plant. It is a view of the interior of the powerhouse in question, showing the three generators. Beyond them, up high, is the high-tension switchboard, and above that are the choke coils and gaps of the lightning arrester, and beyond this are the insulators where the wires pass through the holes in the building to the exterior. On the other side, underneath the lights, is the electric switchboard. By the side of this are the handles on the hydraulic switchboard.

Q. 20. Are those the handles that you have referred to in your previous answer for regulating the supply of water to the wheels and as controlling the by-pass device you have mentioned?

A. Yes, sir.

Q. 21. Please mark on this photograph in ink each of said handles, designating the same with a letter, and state what the handle designated by each letter performs in that plant.

A. On looking at this photograph I remember another handle. This handle controlled a hydraulic cylinder part way up the penstock, and from there this cylinder operating by means of a wire cable a swinging gate in the forebay which regulated the height of the water in the forebay, this being kept at a certain height which was shown by a light and pointer on a gauge on the mountain outside of the forebay, which we could see through an old transit telescope just outside the power house. The handle marked "a" we call the master switch, and this controlled all three hydraulic gates leading to the water wheels. The handles "b", "c" and "d", controlled the individual gates of the separate wheels. The handle "e" controlled the by-pass gate outside the building. The other handle, which is not shown on the photograph and which is back of the handle "e", controlled the water level in the forebay.

Q. 22. You have referred to the employment of a man at this plant when you were there aside from the switchboard man, in connection with the manual

regulation of the water wheels. Why was it necessary to have this extra man?

A. Because when any trouble would hit the plant the switchboard man would have all he could attend to at the electric switchboard. Another man was required to take care of the hydraulic work of the station, and this was the assistant's job, to regulate the water at the call of the man on the switchboard.

Q. 23. What do you mean in your last answer by the words "trouble hitting the plant?"

A. When heavy changes of load, or a short-circuit on the line, or a broken wire in the transmission line, or anything other than a steady, continuous load occurred, we called that trouble.

Q. 24. What specific things occurred on the circuit supplied by this station causing such troubles?

A. The general conditions that a high-tension line is subject to. For instance, lightning conditions. Also, we would be troubled more or less with sand hill cranes flying across the wires causing a short-circuit which usually made a sharp pull-down on the plant for a short space of time, throwing one or two generators out of synchronism, and also broken insulators.

Q. 25. Are you able to state from your engineering experience what sort of fluctuations in load on an electrical circuit are caused by the electromagnetic operation of dredgers for excavation work? That is, dredges operated by electric motors energized by an electrical supply system.

A. Only from my observation of steam-operated dredgers.

Q. 26. Are you able to say how extensive the fluctuations in load are due to the operations of such dredges, irrespective of the character of the prime mover operating the dredge?

A. All I could say is that the load variations are extreme, from what my observation has been.

Q. 27. How would such extremes of load variation compare with the load variation you encountered on the circuit of the Power Development Company plant that you have told us about?

A. They would be somewhat similar to the load of a street car, although very much heavier in extent.

Q. 28. Have you ever visited a hydro-electric central station in which the water wheels were regulated or governed automatically in any manner?

A. Yes sir.

Q. 29. In the operation and control of such a central station, assuming that everything is running properly or normally or is in perfect repair, how many men are employed to supervise the operation thereof?

Mr. Westall: Objected to on the ground that the witness has not shown himself qualified to testify as to matters of opinion on such facts.

A. The plant I used to visit quite often when I was working for the Power, Transit & Light Company, was the Edison Electric Company's Plant No. 1 on the Kern River, just above the head gates of our

power plant. When this was finally placed in operation later on, I have been in the power house a considerable time when the boy at the switchboard operated the entire plant, having full control of the plant.

Q. 30. By Mr. Blakeslee: Why was no assistant or second man required at such plant?

A. On account of the governor action, and also because of the switches being electrically controlled, making their operation easy for the operator.

Q. 31. What were the relative sizes of the Power Development Company plant and this Edison plant, pertinent to output in kilowatts or horsepower?

A. The total capacity of the Power, Transit & Light Company's power house was supposed to be about 2100 horse-power, while that of the Edison Electric Company's plant was about 30,000 horse-power.

Mr. Westall: We move that the answer be stricken out as showing that the witness has no definite knowledge on the subject. His language is "it was supposed to be", showing clearly that this is true.

Q. 32: By Mr. Blakeslee: What is the source of your information as to these approximate horsepower outputs?

A. The rated capacity of a machine is shown on the stampings thereon.

Q. 33. Now, as to this extra man employed at the plant of the Power Development Company when you were there, how long a shift did he work?

A. Eight hours a day.

Q. 34. And how much of the time of the twenty-four hours was the plant operated?

A. Twenty-four hours.

Q. 35. How about the other 8-hour shifts?

A. There were three shifts of 8-hours each, making the twenty-four hours.

Q. 36. And a man for each of those shifts?

A. Yes; there was a switchboard man for each shift and an assistant for each shift.

Q. 37. Do you know what the assistants on those three shifts were paid each a day, or month?

Mr. Westall: Objected to as immaterial.

A. New men were paid \$60 a month and after they had been there for some time they were raised to \$65.

Q. 38. By Mr. Blakeslee: Did this cover their board and lodging or not.

A. No; the board was deducted from this amount in about \$22 a month.

Q. 39. So there was an expense at that plant at that time to the operating company of upward of \$180 to \$195 a month for the three extra men for the three daily shifts, which men assisted the switchboard man in regulating the speed of the water wheels. Is that correct?

Mr. Westall: I object to that as immaterial, and also on the ground that the witness has not been shown to be qualified to give the amounts of wages or amount of money expended in the maintenance of the plant.

Mr. Blakeslee: The questions call for the knowledge of the witness, and counsel may in cross-examination determine how certain his knowledge is, if he wishes.

Q. 40. You have referred in previous answer to certain means for coupling the generator and water-wheel carrying shafts or shaft portions of this Power Development Company plant while you were employed there. How many such coupling devices were there in that plant?

A. There were three coupling devices. However, I believe one of these is a plain flange coupling with a fly-wheel.

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21 at end of line add "together with the title of the court and cause and the date upon which said exhibit was offered"

inclusive, as "Complainant's Exhibit Wilson Photograph No. 1", and ask that the same be so marked.

(The said exhibit so offered in evidence is marked "Complainant's Exhibit Wilson Photograph No. 1").

Q. 41. By Mr. Blakeslee: During the time you were connected with this Power Development Company plant was there or was there not any relief opening within the power house from the penstock or the water feeder pipe from the penstock to the water wheel, whereby any portion of the water could be discharged therefrom and by-passed around the wheels or either of the wheels?

A. There was a short duct just below and to the rear of the butterfly valve which extended downward toward the floor, but all the time that I was at

the plant or have seen the plant before or since, this was covered by a flange or plain plate of cast iron and was never used.

Q. 42. Was there any valve of any kind at that point at the time you were with this plant to control the discharge at that point from the feeder pipe?

A. No, sir.

Q. 43. Exteriorally of this plant were there any penstock or feeder pipe adjuncts at the time you were there?

A. Yes, sir.

Q. 44. What was the nature of the same?

A. There was an air chamber or cylinder which was kept full of air. This chamber was about 3 feet in diameter by about 15 feet high, and was kept filled with air by means of two air pumps which were belted from generators Nos. 1 and 2, and which could be thrown into operation until the chamber was filled with air and then thrown out of operation.

Q. 45. And what was the function or purpose or office of this air chamber?

Mr. Westall: Objected to in that the witness has not been shown to be qualified to answer questions as to the function and purpose of different parts of the apparatus.

A. For the purpose of absorbing any surges in the water-column or water-hammer.

Q. 46. By Mr. Blakeslee: Now, you have referred to a certain relief valve or by-pass in the penstock outside of this power plant, and which was hand-operated by means of one of the levers letter-

ed by you in "Complainant's Exhibit Wilson Photograph No. 1." How was such relief or by-pass used, and for what purpose?

A. When it was desired to close the plant down quickly this lever was thrown first, which opened the hydraulic valve on the end of this pipe, allowing the water to flow from the penstock out through this pipe back into the river. Then the other three levers could be thrown, which would close the valves controlling the water leading to the water-wheels.

Q. 47. Why was it necessary first to operate this by-pass or relief valve manually in the penstock outside of the power house before moving the gates of the several wheels in a closing direction?

A. Because the gates when hydraulically operated would close off the water so fast that the water surge causes a pressure which might become dangerous and which could easily be relieved by opening this discharge pipe at the side of the power house.

Q. 48. Was there any automatic action in connection with the parts which could be operated by any of these levers "a" to "e", inclusive, and so marked in "Complainant's Exhibit Wilson Photograph No. 1"?

A. No, sir.

Q. 49. Did any damaging results or effects occur at this plant while you were there at the times mentioned, due to inertia effects in the penstock or pipe-line?

A. No, sir. The by-pass was always operated and would relieve the pressure, although when first

closing down the hand valves the water would jet forth with apparently more velocity than later on.

Q. 50. Jet forth at what points?

A. At the end of the small 12-inch outlet or by-pass, outside of the plant.

Q. 51. Do you refer now to the hand-controlled by-pass outside of the power house in the penstock that you have testified about before?

A. Yes, sir.

Q. 52. Was there any other relief valve controlled on the water line supplying water to the wheels of this plant than this manually controlled outside by-pass in the penstock?

A. No, sir.

Q. 53. In the control of that plant how were the attendants apprised as to the necessity for manually governing for the speed of the water-wheels, aside from the indications upon the tachometers you have referred to?

A. By the sing of the generators you could tell whether the plant was speeding up or slowing down.

Q. 54. Were you or were you not in communication with various points upon the circuit for the purpose of being informed of varying load conditions?

A. Yes, sir; we had telephone communications with the sub-station, which, in turn, was in communication with the flouring mill, and at the substation also was the rotary converter for handling the railroad, and when such loads were going to come on or start up the rotary converter in the morning at about 5:30, and start the flouring mill synchron-

ous motor, they would call us up so that we would be ready to handle it in case it made a bad "synchronous shot." That is, if they would throw the motors onto the line out of step and thus cause a bad pull-down on the line.

Q. 55. What do you mean in your last answer by "pull-down"?

A. A suddenly increased load causing a reduction in the voltage, and, usually, a reduction in the speed, if it lasted long enough, in the generator.

Q. 56. Now, had there been installed at this Power Development Company plant when you were there some automatic governor for regulating the speed of the wheels and of the flow of the water to the wheels, and for taking care of the inertia effects or counteracting the inertia effects or preventing inertia effects in the pipe-line, or some automatic apparatus of this sort of some type or other, such as you say was installed in the plant of the Edison Company further up the Creek, would or would not these precautions with respect to telephonic notification, tachometer notification, and extra assistant for manual operation of the several controlling levers, etc., have been required in order to keep the speed of the wheels constant during load variations upon the circuit?

Mr. Westall: Objected to as calling for matters of opinion which the witness has not been shown to be qualified to give.

A. No, sir. If some automatic apparatus of a similar type had been had and had been applied to

this plant it could have had the speed of the generators maintained constant with varying loads.

Q. 57. By Mr. Blakeslee: And how with respect to preventing dangerous inertia effects in the pipeline? Would or would not that also have been likewise taken care of?

Mr. Westall: The same objection.

A. Yes, sir; that would have been taken care of.

Q. 58. By Mr. Blakeslee: Now, in this Power Development Company plant during the time you were there, was there anything in place or operative in the nature of a governor for regulating the speed or maintaining constant speed of the water wheels or for preventing dangerous inertia effects in the pipe-line, other than the manually operated devices or features you have told us about?

A. No, sir.

Q. 59. I show you what purports to be another photograph and ask you if you know anything about it, and, if so, what.

A. This is another photograph from my collection, having been given to me by Mr. Carpenter who took the same and who was the foreman of the plant when I was an operator there. This view is one looking between the generators at the control mechanism and the water intake of one of the water-wheels. Also, an exciter generator in the central foreground, and just beyond it with a lifting eye on top, is the water-wheel operating it. To the side of it is the gate-valve controlling the water to the exciter water-wheel, and the pipe leading from the penstock to supply it with water.

Q. 60. What plant does this photograph pertain to?

A. This is in the power house of the Power, Transit & Light Company, to which I have previously referred.

Q. 61. When was this photograph, and when, also, was the photograph "Wilson Photograph No. 1" taken?

A. The photograph "Complainant's Exhibit Wilson Photograph No. 1" was taken while I was at the power house in the summer of 1906. The photograph I here have is one taken some time before that as some of the apparatus shown in the photograph was not on the machinery when I was there.

Q. 62. Does this photograph show the gate you have previously referred to, or valve, controlling the supply of water through the feeder pipe to the wheel in its casing under manual control?

A. Yes. sir.

Q. 63. Where is that valve shown? Please mark the same with the small letter "f".

A. (The witness does as requested.) The manually operated valve is controlled by a wheel marked "f". This wheel operates a valve inside of the casing marked "g" by means of a worm and gear shown at "h". The hydraulic valve operated from the hydraulic board is marked "i", and is controlled by the hydraulic cylinder "j"; and, in order to relieve the pressure upon this valve in opening it, there is a by-pass valve marked "k" which could be opened, relieving the pressure from the big gate-valve so that it could be moved.

Q. 64. Where did that by-pass lead to?

A. It led from one side of the hydraulically operated valve around to the other side.

Q. 65. How were these valves and each of them primarily operated?

A. The valve shown in the casing "g" was manually operated by means of the wheel "f". The by-pass valve "k" was manually operated by means of the wheel "l", and the valve in the casing "i" was operated by the hydraulic cylinder "g" which, in turn, was manually operated by the handle of the hydraulic board marked "b".

Q. 66. Which of these valves is the butterfly valve you have referred to previously?

A. The valve in the casing "g", which is controlled by the worm and gear and hand wheel "f".

Q. 67. Why was a butterfly valve provided at this point?

A. It was more easy to control it than to move any gate-valve.

Q. 68. For what reason?

A. Because the water pressure action is balanced on the valve, while with a gate-valve the water pressure causes it to press against its seat, making it difficult to move.

Q. 69. I show to you "Defendant's Exhibit XX", and ask you if you find therein anything analogous to any of the features of installation at this Power Development Company's plant which were there when you were there?

A. No, sir; there was nothing at the plant like this when I was at the plant during the years 1905, 1906 and 1907, and while I worked there in 1906.

Q. 70. I show you now "Defendant's Exhibit ZZ", and ask you if you recognize in the showing thereof

anything analagous to what was present at the same plant at any time while you were there?

A. This represents a fly-wheel governor of a type similar to that at the power house, which, however, was not in use, and only a few parts were still in place on the fly-wheel; and, secondly, I could not identify exactly whether this was the same kind of governor or not.

Q. 71. Was there any kind of complete governor at this plant when you were there?

A. No, sir.

Q. 72. Where were these parts installed in that plant at the time you were there?

A. On the fly-wheels which join the water-wheel shaft to the generator shaft in generators Nos. 1 and 2. I don't remember whether there was anything at all on the fly-wheel of generator No. 3 or not, but I believe not.

Q. 73. In what sort of relation were the water-wheel shafts and generator shafts so joined in these units Nos. 1 and 2?

A. They were rigidly joined through fiber, to prevent making a joint through which electricity would pass, but a joint through which mechanical energy could be transmitted.

Q. 74. And was there or was there not any relative movements in the shafts through the rigid couples so established?

A. No, sir.

Q. 75. Were there any movable levers, weights or springs on these shaft-connecting parts when you were there or not?

A. There might have been levers, shafts or springs,

but, if so, they were fastened on so as to be immovable, because the apparatus was not in use at all.

Mr. Blakeslee: We offer in evidence the photograph last lettered by the witness, as "Complainant's Exhibit Wilson Photograph No. 2'", and ask that the same be so marked.

(The said photograph so offered in evidence is marked "Complainant's Exhibit Wilson Photograph No. 2'.")

Q. 76. By Mr. Blakeslee: I show you "Complainant's Exhibit Exterior of Power Development Company's Plant'", and ask you if you recognize anything therein pertinent to any feature exterior to the plant that you have told us about in your previous testimony?

A. This is a photograph taken evidently quite a while before I saw the plant, but it shows the penstock coming down the side of the mountain, and also the air-chamber at the side of the building on top of the penstock, and also down near figures 324 is the cement tail-race where the water left the plant. The point where the wires left the plant on the end are also shown. The flume line shown in the picture was not there when I was there. The water at that time came down through a tunnel inside of the mountain.

Q. 77. You are now referring to what plant, in your last answer?

A. The Power, Transit & Light Company's plant, on the Kern River.

Q. 78. Which you have previously testified to?

A. Yes, sir.

Q. 79. I now show you five pencil carbon impression sketches and ask you to state briefly what each of same signifies to you, if anything, marking them in sequence

with capital letters of the alphabet, beginning with "A".

A. The print marked "A" is a diagrammatic sketch of a water-wheel nozzle arrangement, having two nozzle outlets each controlled by needle-valves worked in opposition by means of a lever arrangement, one of these applying on the water-wheel and the other passing below the buckets or vanes on the water-wheel.

The print "B" shows a nozzle arrangement consisting of a series of water-gates acting as nozzles through which the water passes against the ^{vanes} ~~valves~~ on the water-wheel; also a by-pass valve in a by-pass way so arranged that they are operated by a "single-lever-action controlling" means, so that as the water-gates are closed the by-pass valve is opened. The by-pass in this case is a
1626 8½ at end of line add "together with the title
of the court and cause and the date upon
which said exhibit was offered"

The print marked "D" shows a water-wheel and nozzle block arrangement with two nozzles, one applying on the wheel and the other passing below the wheel without striking the vanes, and a slide-plate with openings so arranged that when one nozzle is open the other is closed, and an operating rod for operating the valve-plate.

The print marked "E" shows a nozzle arrangement and water-wheel in which there are two nozzles, one applying on the water-wheel vanes and the other passing below the vanes without striking them, each nozzle being operated by a gate-valve operated through lever actions and control-rods by means of a governing cylinder and piston, the linkage so arranged that when one nozzle is open the other is closed.

Q. 80. Is it possible for you in any way to classify the types of valves shown in these five prints in any general way, or in any general classes, and, if so, please do so. That is, classify them with respect to the nature of action or the nature in which the cooperating features in opening and closing act.

A. The valves shown in prints "A", "B" and that applying on the wheel in "C", are valves in which the opening and closing is accomplished without sliding the valve parts, while that shown on the by-pass in "C" and gate in "D" and "E", the closure is accomplished by the parts sliding on seats to effect closure.

Q. 81. What, if any, pressures affect the parts sliding on seats last mentioned?

A. The water pressure causes the valve to be pressed against the seat.

Q. 82. And what is the effect so produced with respect to the valve apparatus?

A. It causes friction.

Q. 83. What is the effect of such friction in the valve operation?

A. It makes it hard to work.

Q. 84. How does that difficulty or opposition to valve action compare with the valve action pertinent to the valves shown in sketches "A" and "B" and applying to the wheel in "C"?

A. These valves shown in "A", "B", and applying to the wheel in "C", are more or less balanced as to water pressure—almost perfectly so when in partly open and closed positions.

Q. 85. And as between these two groups of valves is

there any preference to be stated with respect to the freedom of action and responsiveness to actuation?

A. Yes, sir; the balanced valve is usually used in a governing mechanism. For instance, the valves controlling the steam on a steam-engine is usually a double-seated valve, with the pressure operating above on one and below on the other, so as to balance the pressure.

Q. 86. And with respect to the sensitiveness and responsiveness of valve-action, what effects are produced in a sliding type of valve mounted within or under the pressure of the fluid controlled by the valve?

A. The more the valve becomes closed the greater the pressure causes it to press against the seat, and the greater the friction necessary to be overcome in moving it.

Q. 87. I show you "Defendant's Exhibit Berry Blueprint No. 1," and ask you to look at the valve marked "41", and also at the valve marked "48", and ask you further to state to which of the classes, if either, you have just designated, such valves or either of the same applies.

A. These are both cylindrical valves similar to that shown in the by-pass on print "C", and are likely to require considerable friction to be overcome in their opening or closing.

Q. 88. Have you ever previously testified in any suit involving the interpretation and infringement of U. S. Letters Patent?

A. Yes.

Q. 89. Can you mention the names or titles of any such suits?

A. Hardison vs. Payne, concerning an oil-well perfor-

ator; also in the Union Tool Company vs. the Wilson & Willard Manufacturing Company in reference to oil-well under-reamers; also in E. C. Wilson vs. Union Tool Company, also in reference to oil-well underreamers; also Willard & Willson vs. Union Tool Company, in reference to ~~the~~^a rotary well-drilling apparatus.

Q. 90. Do you remember where these suits were brought, and where they are pending—in what court?

A. In the Circuit or District Court of the United States, for the Southern District of California, Southern Division.

Mr. Blakeslee: We now offer in evidence the five sketches just considered in this deposition by the present witness, as “Complainant’s Exhibits Wilson Sketch A, Sketch B, Sketch C, Sketch D and Sketch E”, respectively, and ask the same to be so marked.

(The said sketches so offered in evidence are respectively marked “Complainant’s Exhibit Wilson Sketch A”, “Complainant’s Exhibit Wilson Sketch B”, “Complainant’s Exhibit Wilson Sketch C”, “Complainant’s Exhibit Wilson Sketch D”, and “Complainant’s Exhibit Wilson Sketch E.”)

Mr. Blakeslee: This concludes the direct examination of this present witness unless, of course, he should be recalled, and counsel for defendant may have opportunity to cross-examine this witness upon returning to this city, as to be jointly arranged between him and counsel for complainant, all to the end that counsel for defendant shall have such opportunity within one week from the time of returning to the city from the trip upon which both counsel are now about to go for the further taking of proofs in this case.

Bakersfield, Calif., Feb. 18, 1915, A. M.

JAMES F. DEARTH, a witness produced on behalf of complainant, being first duly sworn according to law to testify the truth, the whole truth and nothing but the truth, testified in rebuttal as follows:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 1. Please state your full name, age, residence and occupation.

A. James F. Dearth; age, sixty-nine; place of residence, Southern Hotel, Bakersfield, California; occupation at present is carpenter and contractor.

Q. 2. How long have you been occupied in the business of carpenter and contractor?

A. Just recently; about five years, or between four
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cause and the date upon which said exhibit
was offered"

work in this part of the country what was your occupation?

A. I was superintendent of a hydro-electric plant.

Q. 4. At what place?

A. In Kern County, State of California.

Q. 5. Can you locate the part of the county a little more definitely?

A. Sixteen miles east from Bakersfield at a point known as Kern Canyon, on the Kern River.

Q. 6. That is the point at which we are taking this testimony today?

A. It is.

Q. 7. When did you commence your connection with this power plant as superintendent.

A. If I remember correctly, it was sometime in December, 1895. I can tell you to a day. I came out to this Canyon on the 24th day of December, 1895. I am not sure of the year, but I think I am right. I looked through the records this morning, and, as near as I can locate it, it was 1895 that we commenced working here.

Q. 8. What was on the property where the plant now stands at that time?

A. Nothing but rocks.

Q. 9. What was the name of the concern operating, controlling or owning that plant or that property or prospect at that time?

A. The Power Development Company of Bakersfield.

Q. 10. Can you mention the names of any other persons who were connected or associated with that company at that time, and what their offices were?

A. The manager was Carroll N. Beal.

Q. 11. Where did he reside?

A. At that time in Bakersfield.

Q. 12. Do you know where he resides now?

A. San Francisco, California.

Q. 13. Previous to connecting yourself with the Power Development Company had you had any experience in superintending power plants, or in any capacity, in connection with power plants?

A. No, sir.

Q. 14. How did you come to connect yourself with the Power Development Company at that time?

A. Through Mr. Beal.

Q. 15. Had you prior to that time been a contractor and carpenter?

A. Yes, sir.

Q. 16. What was the first work you did on the ground here when you came in 1895?

A. I constructed a bridge across the Kern River about half a mile below the present power house site.

Q. 17. Did you have anything to do with building the power plant?

A. I did.

Q. 18. To what extent?

A. I built the power house, cottages, and all the necessary buildings for the operation of the plant. And, furthermore, I built a flume conveying the water from the river to a point where it is discharged into the pipeline coming to the power house. The flume was over 9,000 feet long. It was a wooden flume on the side of the mountain.

Q. 19. How far from the site of the present plant was the intake point of that flume?

A. Approximately 9,000 feet.

Q. 20. Did you at that time, or have you since, explored the Kern River Canyon to any extent above that intake?

A. Not very closely. I have been up several times.

Q. 21. How far?

A. Democrat Springs and Borel Springs.

Q. 22. How far is that?

A. The intake of the Edison plant is 9 miles above the power house and 2 miles above this power house, which makes it 11 miles from this power house.

Q. 23. Was this power plant or any other power plant

in the Kern River Canyon, or supplied by the Kern River, upstream from the present plant at the time you first came here?

A. No, sir.

Q. 24. What is the general formation of the country and slopes of the country or canyon from the point of the Power Development Company plant up to the 11-mile point to which you have explored it?

A. It is like it is here; a very deep canyon with high mountains on each side and all rocks.

Q. 25. Is there any vegetation on the slopes, or has there been at any time?

A. Very little. Some places there would be a few scrub trees growing, or something of that kind.

Q. 26. How large in diameter were the stalks of these trees?

A. The largest would not be more than 6 or 7 inches through.

Q. 27. How long were you connected with this plant?

A. About fourteen years, I think. Fourteen or fifteen.

Q. 28. During that time were you ever troubled with floating debris or twigs or sticks or broken-down vegetation coming into the flume or penstock?

A. Yes, sir.

Q. 29. To what extent and in what manner?

A. To the extent of closing the pipe down at several different times, choking up the grizzly. The grizzly, you understand, is bars to strain this stuff out. So that we had to shut down.

Q. 30. That grizzly was between the flume and the penstock?

A. There was one at the intake of the flume, a coarse one, taking out the coarser material; and then there was another one at the forebay of a finer screen.

Q. 31. What were the meshes?

A. The one at the forebay, if I remember right, was about $3/4$ of an inch. The one above was about $2-1/2$ inches.

Q. 32. How effectually did these grizzleys screen the penstock?

A. Well, we had no trouble with the water after it passed the grizzley, with this exception: There was a large amount of sand running in the flood waters.

Q. 33. Have you ever taken steps to ascertain the nature of the water in those mountain canyons supplying hydro-electric power plants, as to the content of ~~that~~ sand? Or do you know anything about that?

A. No, sir.

Q. 34. Do you know whether or not this Kern River varies from other streams in that particular?

A. Only by hearsay.

Q. 35. Was the normal condition of the water at this plant to have a considerable content of sand?

A. Only during flood waters.

Q. 36. How long a period during the year?

A. It would be intermittent. We might have a rise of two or three or four or five days, and then the water would clear again.

Q. 37. What time in the year?

A. Generally in the winter, from November until some time in March.

Q. 38. Did you ever have any such conditions in the summer time?

A. Once in a great while, due to the heavy showers above. It happened twice, I think, to my recollection.

Q. 39. Do you remember anything about this with respect to the first two years of the Power Development Company plant here, as to whether there was any sand in the water in the summer?

A. We never were bothered with that only in some of our installations at the power house.

Q. 40. Do you remember the years 1897 and 1898 whether you had any serious sand troubles with the water in the summer time?

A. I do not recollect that we did. In fact I know we did not, because they were exceptionally dry years and there were no flood waters that occurred. That was in 1897 and 1898 that you were inquiring about?

Q. 41. Yes. Briefly, what was done as to further construction or installation of this Power-Development Company plant after the building was completed?

A. Machinery was installed in the power house and the pipe-line connecting the forebay to the power house, and the pole line constructed to Bakersfield.

Q. 42. What times were these various steps taken?

A. I think installation work was commenced here in 1895, late in the fall when I commenced, and the following summer we built the flume. The machinery arrived sometime early in the fall. We took the power house and put in the foundation and received the machinery, and during that winter we installed the generators and the water wheels, running over a period of perhaps five or six months. We were fully six months before we had them completely installed. And at the same time this

pipe-line was installed up on the hill. That was done by a contractor in Los Angeles.

Q. 43. About when were the first water-wheels installed?

A. The work was going on there in the latter part of that winter. That would be the winter of 1897. We came in 1895. We were working on construction work in 1896, and I don't think the wheels were put in place until 1897, in the latter part of that winter or early part of that year.

Q. 44. Was that in 1897 that the wheels were ready for their first trial?

A. They were ready for their first trial sometime in June in that year.

Q. 45. What type of wheels were those?

A. They were called Girard wheels.

Q. 46. Do you know who furnished them?

A. They were furnished—I think the name of the firm was the California Electric Company, but I am not positive. B. C. Van Emon was president and was here in charge of the construction work.

Q. 47. Did you ever hear mentioned in connection with those wheels the name of the Girard Water Wheel Company?

A. Well, it was called the Girard water wheel. I do not understand that they were manufactured by any company of that name. It was called the Girard wheel.

Q. 48. What generators were installed in connection with these Girard wheels?

A. The General Electric.

Q. 49. How many of these wheels and how many generators were installed first?

A. Two of them.

Q. 51. ~~And two wheels?~~ *Two of each?*

A. No; two units, two generators.

Q. 50. ~~Two of each?~~ *And two wheels?*

A. Well, there were two wheels in each unit. The two wheels and the generator comprised a unit.

Q. 52. Two units each of two wheels?

A. Yes, sir.

Q. 53. And each unit was coupled up with a generator?

A. Yes, sir; coupled direct.

Q. 54. In what manner were the wheels coupled up with the generator in each instance?

A. Well, if you will follow me closely, I can give you an idea, pretty near. On the end of the generator shaft, which is 8 inches in diameter, is a heavy cast flange. The fly-wheel that is suspended between the generator and the water-wheel case has a similar flange cast to it. The fly-wheel is bolted direct to the end of the generator shaft through the medium of these flanges. An insulating washer of fiber was inserted between the flanges when they were bolted together.

Q. 55. The water-wheel shaft entered the fly-wheel proper up to the generator shaft?

A. The generator shafts and the fly-wheel shaft met about at the point where these two flanges meet. Do you get the idea? Where the two flanges bolted together, the water-wheel shaft came in, and the other was keyed solid to the generator shaft, and the fly-wheel was bolted to it, and then the opening was left there and the water-wheel shaft and 6-in. shaft would not close up to the end of that shaft, and this was connected to the fly-

wheels through a system of levers or what Mr. Cobb termed a dynamometer, which had the effect of weighing the load which was transmitted from the water-wheel to the generator. This was done through a system of levers, weights and springs. That is the way they were connected together. I think that answers the question, does it not?

Q. 56. You have mentioned Mr. Cobb in your last answer. Who was he?

A. Edwin S. Cobb. He was our supervising engineer. I will change that. He was a hydraulic engineer.

Q. 57. Was one of these dynamometers provided for each of the two units that you have spoken of?

A. One was made in each fly-wheel.

Q. 58. Were those two units or either of them provided with any means for governing the speed of the water-wheel?

A. Yes, sir.

Q. 59. What was the general nature of such means?

A. I want to get that clear, if I can. I know it from start to finish—every bolt and screw about it. The dynamometer which was mentioned was connected through a sliding sleeve on the water-wheel shaft to a bell-crank connecting with a system of bell-cranks and connecting with a hydraulic engine, and connecting with the by-pass and throttle valves, as you might term them, or whatever you do term them, that were located in the nozzle blocks. Have I got that straight?

Q. 60. We can't tell you. You are testifying.

A. I am gong right through from the fly-wheel to the mechanism which by-passed the water and controlled

the water on the wheels. You have got it straight as it goes.

Q. 61. How did this dynamometer act in connection with such so-called by-pass?

A. At no load, running at normal speed, which was 257 revolutions per minute, the equalizing levers in the dynamometer were terraced—closed. As the load increased the centrifugal pull spread the levers actuating this sliding sleeve through the medium of the bell-cranks operating on the hydraulic engine. That in turn operated on the by-pass, and the valves in the nozzle blocks.

Q. 62. And when the valves in the nozzle block were operated on what effect was produced?

A. They opened and closed as the occasion demanded. As the load increased, the effect on the hydraulic engine was to open the nozzle block and close the by-pass, thus increasing the power on the wheel as demanded.

Q. 63. Were the shafts on the generator and on the water-wheel in each unit connected in any way other than by this dynamometer?

A. They were not.

Q. 64. Then it was possible for a change in speed of the water-wheel to take place at the same time a change in load took place upon the generator?

A. A change in the load on the generator would either speed the wheels by closing them down, invariably, without any device whatever to remedy that. That is the result. The more load the less speed, or the less load the more speed, without any intervening device.

Q. 65. Were there any other fly-wheel devices on these shafts?

A. No, sir.

Q. 66. Was there any other governor device used in connection with these Girard wheels and the generators connected with them? That is other than this dynamometer?

A. No, sir. Yes, there was; there was, independent of the dynamometer.

Q. 67. What was that?

A. By manipulating the operation of that ram by hand.

Q. 68. What ran was that?

A. The hydraulic engine. We call it a ram or engine.

Q. 69. What did it have so as to be controlled by hand?

A. It had a little hand-wheel on a sliding sleeve that you could move and change the position of the balanced valve so as to admit more water to the ram—admit the water at one end of the ram for opening of the valves and on the other for closing the valves.

Q. 70. Was it ever so used by you? That is, by controlling it by hand?

A. A great many times.

Q. 71. Why was it necessary that this hand-control was provided?

A. The mechanical control contained in the fly-wheel did not meet the requirements.

Q. 72. And what effect did that have upon governing the water-wheel?

A. It gave too wide a range of speed.

Q. 73. And what was the effect of this too wide range of speed?

A. An increased voltage, or a decreased voltage and

slowing down of the motors connected on the plant, or speeding them up.

Q. 74. What result would that have upon proper governing?

A. I don't quite get that question.

Q. 75. What would be the effect of that with relation to proper governing?

A. Proper governing should give you uniform voltage and speed, to get the ~~best~~ best results and give the best satisfaction to your customers.

Q. 76. Did you have any complaints as to variations of voltage on the circuit of this plant when the dynamometers were relied upon?

A. We certainly did.

Q. 77. And after receiving such complaint was the dynamometer relied upon to automatically attempt the governing?

A. Not fully; no. We kept a man on watch all the time.

Q. 78. What did such man watch?

A. The speed fluctuations.

Q. 79. And when he found extensive fluctuation what did he do?

A. You understand that the line was new. The installation was new all through, and we were subject to severe shocks due to the line coming down and the lines coming together—what we call a short. That would slow your speed right down because it would put a very excessive load on your machine. The governor would not take care of it at all. It was a question of shutting down the plant when it came to be severe. If it was not so severe the second man in the power house, who was al-

ways where he could reach this hydraulic engine, would take hold of that little hand-wheel and slide that a little one way or the other and make the hydraulic engine shut off or put on the water as the occasion demanded.

Q. 80. How much of the time that these dynamometers were used on the Girard wheels was it the custom to so control or govern the wheels by hand in the manner you have stated?

A. We attempted at first—You understand the load we had here first was what was termed a “non-inductive load”, and was constant. It was incandescent lights, the nicest and easiest load in the world to handle. From local disturbances on the line we did not have any trouble. That is a load that builds up very slow, and with a little assistance, and they always had to have a little assistance on that governor, when the load increased to change the location of this valve that I speak of. I operated alone in there for two or three months at nights, and I would have to slip around there and change that valve occasionally as our load increased. The governor would not adjust it to the right point. There would be a fluctuation. Then, as the load decreased, I would have to reverse the operation. When we began to get motors on the line, when they threw them in, it made a little shock on the line, and it would put on all the way from 10 to 50 horse-power on your line. I had to put the second man in the power house so as to be convenient at all times to handle the hydraulic engine. That is when we were operating with the Girard wheel. We never had any other control on that wheel only through this hydraulic engine, you understand. No butterfly valve. Then, when there was a severe shock came on

the line, the only remedy we had was to shut the plant down—we couldn't do a thing with it—and then start up again.

Q. 81. What was your experience with this so-called by-pass valve and the means you have referred to for operating it in connection with the dynamometer?

A. I don't know hardly how to express my contempt for that. It bothered me nights and Sundays. It never worked satisfactorily for twenty-four hours in succession. The construction of it was against it absolutely.

Q. 82. Can you mention some of the troubles you had with it?

A. The fine silt and sand in the water which the water carries to some extent all the time.

Q. 83. What did that cause?

A. That was a brass cylinder revolving inside of another cylinder, fitting very close. It is exactly the same proposition as what we call a water-service cock. The fine silt and sand worked its way in between the two surfaces and would stick and twist off your bell-cranks and away they would go.

Q. 84. How many different times did such twist and breaks occur, if you recollect?

A. I can't tell you. It broke before we ever started the plant and put it on the line.

Q. 85. What was it necessary to do then?

A. Shut it off and run without it.

Q. 86. How long a duration of time did you run this plant without that by-pass?

A. We would run it—sometimes we had to send to the city to get necessary repairs, and, in any event, we had to take it clear out and clean it up, and it would shut

us off from the by-pass perhaps from five hours to five or six days.

Q. 87. How long was that by-pass device in attempted use? That is, how long did you try to operate it with the rest of the governing system?

A. My recollection is we abandoned that entirely about two months after—I don't think we worked with it over two months' time. We gave it up as a hopeless case.

Q. 88. What was that by-pass device installed for?

A. To protect the pipe-line from unusual pressure, or what is called a ram or shock. For instance, if this governing device had worked out as it was designed and expected to work, and a heavy shock came in on the line, it blowed the fuse. But when we were running at full load, and the load was taken off, the speed would jump from 257 up to the maximum, which is 500, and do it very quick. This governing device would shut the water right off immediately, and in doing so, unless there was some relief to the pipe-line, it would produce a hammer at some point and perhaps split it open. It was for the protection of the pipe-line.

Q. 89. Was there anything else provided in connection with the plant at the time the Girard apparatus was attempted to be used for the purpose of protecting the penstock or pipe-line?

A. There was an air-chamber installed on the pipe-line when it was constructed for that purpose. That was kept full of air all the time so that in case of a shock it compressed the air and relieved the strain.

Q. 90. What was the occasion for that air receiver?

A. To some extent it was a great help.

Q. 91. How did it work in so helping?

A. It would relieve the pressure by compressing the air and giving more space to the volume of water.

Q. 92. Was any attempt made to operate this by-pass device by any other fluid than water taken from the penstock?

A. Yes, sir.

Q. 93. What was attempted to be used in place of the water?

A. No attempt was made to operate that in any other way except its connection with this hydraulic engine. We made several experiments with the hydraulic engine.

Q. 94. What was the nature of the experiment?

A. We used the water first from the pipe-line, and a provision was made to strain out what they assumed to be the coarse sand that would make the trouble, with a strainer in the pipe before the water reached the engine in this work. Then that failed almost immediately. Mr. Van Emon was here at the time, and gave it up. Then the next thing, we installed a 30-gallon tank at the power house and filled it with light oil and put that under pressure from the pipe-line and operated the hydraulic engine with the oil. That did not work satisfactorily. The next thing we done we installed a 500-gallon steel tank and connected it up with a spring we have for domestic purposes and which is pure clear water and no sediment whatsoever in it. On all the operations we ever had with the hydraulic engine afterwards, it was operated with that water. The water gave no trouble after that.

Q. 95. Was the by-pass attempted to be operated

with this spring water as the fluid for the hydraulic engine?

A. It was.

Q. 96. Did you get any better results?

A. Not that we could notice; not with the by-pass.

Q. 97. What kind of repair work did you have to do with respect to this attempted by-pass device when you found that it was giving trouble?

A. Whenever that balked on us, the engine had sufficient strength to break the bell-crank connections connecting it with the engine, and invariably the casting broke. Then we knew the cylinder was stuck in there, and then it was a question of taking it out and getting that cylinder out and cleaning it up and getting new castings and putting them back.

Q. 98. How soon after new bell-cranks or levers were put in the place of the broken ones did you have further breakage of that same thing?

A. I can't tell you that. We got them frequently. My recollection is that we ordered a duplicate set so as to be prepared for it.

Q. 99. How early, approximately, did you have a further break after you had repaired the parts which had been previously broken?

A. It might last ten days or two weeks. I don't think any of them exceeded two weeks before we would have to take it out. Sometimes we would see it would work sluggish, and we would disconnect it and take it out and clean it and avoid a breakage.

Q. 100. And was this a part of the general operation of the plant,—attending to the by-pass?

A. That was part of our work, to keep it going.

Q. 101. You have stated that you attempted to use this by-pass about two months.

A. As near as I can remember.

Q. 102. What was done at the end of these two months with this by-pass?

A. Disconnected it entirely.

Q. 103. What was done with it?

A. It was taken out and junked.

Q. 104. Was any other by-pass device to take the place of it?

A. No, sir; not with the Girard water-wheel.

Q. 105. Was there ever any by-pass device put in place of it to be operated by a governor?

A. Oh, yes. On the Knight wheel.

Q. 106. What became of that by-pass?

A. We installed two of them. They are now in place. We abandoned them and sealed them up, and they stand there.

Q. 107. Why did you abandon them?

A. They wouldn't work at all.

Q. 108. What governor was used in attempting to operate them?

A. The same that we used with the Girard, only a little different, to meet the conditions.

Q. 109. The dynamometer, do you mean?

A. Yes, sir.

Q. 110. How long were these second by-passes attempted to be used?

A. My recollection is about ten or fifteen minutes. Not over that.

Q. 111. When you attempted to operate this first

by-pass, or these first by-passes by hand, what results did you get?

A. The by-pass would operate all right so long as it was working free. Whenever the engine worked it worked simultaneously with the engine. The engine worked that and the valves controlling the wheels at the same time when the by-pass was free.

Q. 112. But it was necessary to control it by hand at such time?

A. No; not necessarily. When it was free it would work just as well as the valves would in the nozzle blocks.

Q. 113. Did you have any trouble in working with the nozzle blocks?

A. Oh yes. We certainly did.

Q. 114. How long altogether do you suppose the attempted by-passes were actually in use in connection with the Girard wheel?

A. I don't think the by-pass was used to exceed two months. Understand, after we put the plant in condition we ran here for probably two or three weeks an hour or two at a time by way of testing out, but after we got it going so that we were giving service I don't think it was exceeding two months that we could use the by-pass.

Q. 115. How much of that time do you think it worked, one way or the other?

A. Probably one-third of that time.

Q. 116. If you were to install or assist in installing a hydro-electric power plant at the present time, would you advocate or permit the installation of a by-pass of such kind first used by the Girard water wheel?

A. No, sir.

Q. 117. For what reason?

A. Because it was inefficient and was not equal to doing the work.

Q. 118. Did it or did it not not accomplish the work it was expected to accomplish?

A. It did not.

Q. 119. How did the generators operate when driven by the Girard wheels, with respect to efficiency?

A. The best efficiency of a generator is its normal load. We never could deliver to exceed if my recollection serves me right, about 40 per cent, or, possibly 50 per cent, of the real load of the machine.

Q. 120. What do you lay that to?

A. Inefficiency of the water-wheel. It could not deliver the goods.

Q. 121. You mean 40 per cent efficiency from one of the wheels?

A. Well, give it the advantage of all there is and say 50 per cent.

Q. 122. From one of the wheels?

A. From one of the wheels. My recollection is that it was less than that. I know it was a very great disappointment.

Q. 123. As to these various connections between this scrapped or junked attempted by-pass device installed with the Girard wheels, and the dynamometer, what became of them?

A. We scrapped the whole bunch and sent them to the Bakersfield Iron Works for junk.

Q. 124. Do you know whether any of them are in existence today?

A. Some small pieces.

Q. 125. Where are they?

A. At the power house in Kern Canyon.

Q. 126. When did you last see them?

A. Today.

Q. 127. Do you know what was done with them today?

A. They were laid out on the pipe-line and photographed.

Q. 128. And was anybody photographed with them?

A. Yes, sir.

Q. 129. Who?

A. Myself.

Q. 130. Who took the photograph?

A. Mr. Henry.

Q. 131. The complainant in this case?

A. Yes, sir.

Q. 132. I show you two prints respectively marked "Defendant's Exhibit XX" and "Defendant's Exhibit ZZ", and ask you if they suggest anything to you, or mean anything to you, from your experience or knowledge?

A. They look perfectly natural.

Q. 133. In what respect do they look natural?

A. They show the water-wheel. They show the connections on the outside of the water-wheel case with the nozzle blocks inside, controlling the water-wheel. They show the hydraulic engine and its connection with the by-pass. They show the fly-wheel with the assembly in the fly-wheel which actuates the hydraulic engine controlling the water-wheels.

Q. 134. What apparatus have you been referring to in reciting these various parts?

A. The apparatus that controlled the Girard water-wheel.

Q. 135. At what plant?

A. At the Power Development Company's plant in Kern County, State of California, at Kern Canyon.

Q. 136. Any connection between that and the one that you have previously been telling us about?

A. The same one.

Q. 137. Does either of these cuts or do both of these cuts show any of the parts which you have said were photographed today with yourself in the picture, or any parts like that, which were provided for use at that plant?

A. Yes.

Q. 138. Will you please now step to the location of those parts and point out the identity of those several parts with the several parts lettered on these two prints which are last shown you? In this connection I will state that these parts which were photographed have adjacent to them certain numbers. Were those numbers there when the photographs you have mentioned were taken?

A. They were.

Q. 139. Please, then, connect up the numbers of those parts that were photographed with the letters around these cuts.

A. I mark on "Exhibit ZZ" with the figure 1 the part before us; 2 is the same sort of a part; 3 runs right through these parts assembled in the fly-wheel, it don't show it here—yes, it does, right in there. I mark part 3

also on "Exhibit ZZ." The part 4 is the part marked "I". The part 5 is a duplicate of 4. 6 is this piece right here marked "V". The part 7 is a weight right in here that slides on those bars. I will mark it on this exhibit—it is not visible here. They are weights sliding on the bar to balance the wheels. The figure 8 is not visible here; it is on the other side of the machine. Figure 9 a connection of the hydraulic engine, and is not shown here. 10 is not shown.

Q. 140. Are any of these parts before us which are numbered broken at this time, and, if so, which?

A. Yes, sir.

Q. 141. Give the numbers.

A. Number 5 is broken, number 6, number 8 and number 9.

Q. 142. Do you know what was done with any of the junked parts of this attempted Girard water-wheel governing apparatus that is now on the premises here today?

A. Yes.

Q. 143. What was done with it?

A. The cast-iron was delivered to the Bakersfield Iron Works and sold for junk. The bronze metal was sold to the Kern County Land Company for use in their shops.

Q. 144. How long were the Girard water-wheels used.

A. I couldn't tell you certainly about that. It was in commission till we got the other installed.

Q. 145. What wheels were installed next?

A. You recollect we only had one Girard water-wheel

installed. The next one was a Tuthill, manufactured by the Oakland Iron Works.

Q. 146. About when was that installed?

A. That was installed—these were started up in 1897, and the following winter, whether it was in 1898 or late in 1897, but I think it was in 1898, the first Tuthill wheel was put in. We only had two units then.

Q. 147. What did you do with the Girard Water Wheel when it was thrown out?

A. Smashed it to pieces and hauled it away for junk.

Q. 148. How long were you continuously superintendent of the power plant of the Power Development Company?

A. My recollection is about fourteen years.

Q. 149. When did you sever your connection with the company operating it?

A. I couldn't give you the exact date. I could get it for you, because I resigned from this company just one month before the San Joaquin Light & Power Company took hold of it, and just when that was I haven't got any data. I may have it in my desk at home.

Q. 150. Approximately what year was it?

A. That would be five years ago.

Q. 151. How many Tuthill water-wheels were placed in this plant?

A. Two.

Q. 152. That is, two units?

A. Two units; yes, sir.

Q. 153. How many wheels in each unit?

A. Two wheels.

Q. 154. What was used for governing the flow of water to these Tuthill wheels?

A. The same device up to the hydraulic engine; beyond that there was a different device on the water-wheel.

Q. 155. What was the nature of that device?

A. It was in the nature of a baffle-plate shut over the nozzle.

Q. 156. How were those baffle-plates operated?

A. By this hydraulic engine.

Q. 157. Were they at any time hand operated?

A. Oh, yes.

Q. 158. Was any by-pass or relief device used on the pipe-line in connection with these Tuthill wheels?

A. No; it was not necessary.

Q. 159. Why?

A. The water was not shut off in any sense of the word, but just deflected from the wheel.

Q. 160. In other words, if I am correct, the flow of water to the wheels was not changed in volume?

A. Not at all.

Q. 161. What was done with the openings on the pipe-line at which the attempted by-passes were installed for the use of the Girard wheel?

A. They were closed up by iron plates put over them.

Q. 162. Were they ever opened up again?

A. No, sir; not until the Knight wheel was put in.

Q. How long were the Tuthill wheels used?

A. Approximately the same length of time, till we could install Knight wheels.

Q. 164. How many other wheels were put in?

A. Two, at that time.

Q. 165. During the latter part of the operation of the deflectors on the Tuthill water-wheels, how were they operated?

A. They were controlled the same as they were on the Girard, by this movable sleeve.

Q. 166. How much of the time were they operated by hand?

A. Well, nearly all the time. Fully half of the time. The man had to be right there to watch it all the time.

Q. 167. How long was the air reservoir kept on the pipe-line?

A. It was there all the time.

Q. 168. Is it there today?

A. Yes, sir.

Q. 169. Was any other photograph taken by Mr. Henry today in which you formed a part of the picture?

A. Yes, sir.

Q. 170. Where were you positioned at that time?

A. In the power house.

Q. 171. Near what part of the plant?

A. Standing by the desk in the power house.

Q. 172. Any other picture taken with you in it today?

A. Yes, sir.

Q. 173. Where were you stationed then?

A. Sitting by the water-wheel case in the power house.

Q. 174. Who furnished these Knight water-wheels?

A. Mr. Knight of Sutter Creek, California.

Q. 175. What sort of a controlling apparatus was put in with the Knight wheels?

A. A butterfly valve was installed in the pipe-line before the pipe entered the water-wheel gate.

Q. 176. What was that butterfly like?

A. Like the damper of an ordinary stove-pipe.

Q. 177. How does that kind of a valve differ from the service-cock shape form of valve that you have described in speaking of an attempted by-pass device on the Girard wheel installation?

A. Well, the construction of a butterfly is an iron disc inside of the pipe-line, in a chamber that is prepared for it. That will close tight when it is set nearly vertically across the pipe-line. And, as you open it, it lets the water pass through. Opening it to approximately 90 degrees, it leaves it standing the other way, which gives a free passage for all the water in the pipe-line.

Q. 178. When it is opening and closing does the presence of sand that might be in the water have anything to do with the smoothness or ease of its action?

A. Not a bit.

Q. 179. Why?

A. The water has a free passage right through. The sand does not cut any figure with a butterfly valve.

Q. 180. In using the service-cock shape form of valve like the by-pass you referred to, what is the effect of the pressure of water on the valve when it is being turned?

A. The water has an effect to force itself in between the service-cock and the chamber it revolves in.

Q. 181. Are these surfaces in contact when the valve is moving?

A. Yes, sir.

Q. 182. One slides on the other?

A. One revolves inside of the other.

Q. 183. Are any such surfaces in contact in using the butterfly type of valve?

A. There is none.

Q. 184. Do you know who advised putting the air receiver on the pipe-line when the Girard wheels were installed in the plant?

A. That was part of the installation and designed by our hydraulic engineer, Edwin S. Cobb.

Q. 185. And for what purpose?

A. For the purpose of relieving the pipe-line of undue shock.

Q. 186. Supposing this air-chamber had not been provided; what would have been the effects of the water pressure in the penstock when you were operating the water-gates?

Mr. Westall: Objected to on the ground that this witness has not been qualified to testify as an expert in this case, and he is called upon to give matters of theoretical opinion, which his experience, as testified to, has not qualified him to give.

A. I know nothing about that, only from what I hear.

Q. 187. By Mr. Blakeslee: Did you ever have any sticks or twigs or the like come through the penstock and down to the water-gates in the plant?

A. We never were troubled with our water-gates. They are 20 inch gates on the pipe-line. We never were troubled with the gates.

Q. 188. That is, you never were troubled by reason of sticks or twigs tending to jam them?

A. Not at that point.

Q. 189. Where did any such trouble occur?

A. In the nozzle blocks of the exciters.

Q. 190. What were the sizes of the pipes of these gates?

A. Of the nozzle blocks we had two types in the exciters. One of them was a straight nozzle, and three Pelton wheels on one exciter, and their nozzles are 7-8 inches when they are new. They get bigger as they wear.

Q. 191. At any time when sticks or twigs caused any jamming ~~at~~ these points, did it produce any effects of pressure on the pipe-line?

A. No, sir.

Q. 192. What do you understand has been the purpose and function of the air receiver on this pipe-line?

A. To take care of the undue shocks to the line.

Q. 193. In other words, to produce elasticity or yield in the pipe-line?

Mr. Westall: Objected to as leading and suggestive.

A. Yes, sir.

Q. 194. By Mr. Blakeslee: What if any attempt to operate any by-pass device was there in connection with the Knight wheel?

A. Well, that is a long story.

Q. 195. Was it a pleasant story or a sad story?

A. It resulted in disaster.

Q. 196. What happened to produce such disaster?

A. It wouldn't work.

Q. 197. Were there any other disastrous effects?

A. Nothing; only we abandoned it.

Q. 198. How long was it attempted?

A. Ten or fifteen minutes, or possibly fifteen minutes told the whole story.

Q. 199. Are there any parts of such attempted by-pass on the plant today?

A. Two of them down there.

Q. 200. Are they in working condition?

A. No, sir.

Q. 201. What is their condition?

A. They are closed up and sealed.

Q. 202. How long have they been in that condition?

A. Well, since the installation of the Knight water-wheels. They were installed with the Knight wheels.

Q. 203. And it was immediately after that, or fifteen minutes after their attempted use, that they were abandoned and sealed up?

A. Yes, sir.

Q. 204. What, from your experience does the dynamometer you have told us about amount to as an attempted governor?

A. We never found it reliable.

Q. 205. Are any parts of those dynamometers in position in this plant today?

A. Yes.

Q. 206. What is their conditon? How many of them are there?

A. Three.

Q. 207. What is their condition?

A. They are tied up and not in use.

Q. 208. What is used today to connect the water-wheel shafts with the generator shafts?

A. It connects through the same mechanism. Tied up.

Q. 209. In what way are they tied up?

A. I don't know how they ~~are~~ ^{were} tied up. Mr. Easton told me they tied them up.

Q. 210. Did you look at them today.

A. I had no opportunity. I only testified to that as far as my own experience. When I was running the

plant we just disconnected the bell-crank system entirely and removed all of the parts excepting the assembling inside of the fly-wheel. We left that just as it was, and it operates there or did at the time I left the plant just the same as it did, as though it were governing the plant or attempting to.

Q. 211. Is it used in governing the plant today ?

A. No, sir.

Q. 212. Is it used in any capacity except a coupling?

A. It is only used as a coupling between the water-wheel and generator.

Q. 213. How about its being used as a fly-wheel?

A. The fly-wheel is still in position and in use.

Q. 214. What was used in attempting to operate these later by-pass devices put onto the Knight wheels?

A. The same hydraulic engine installed by the Girard people, but in a different place.

Q. 215. Now, at the present time, is anything else used in connection with this plant as auxiliary to the governing of it?

A. Hand government; A butterfly valve.

Q. 216. How many butterfly valves?

A. One in each unit.

Q. 217. Is anything else used in connection with this plant to regulate or check or control the flow of water to the wheel?

A. There ~~is~~ ^{was} not when I left the plant.

Q. 218. Is anything used in connection with this plant on the pipe-line or back of the pipe-line to regulate the flow of the water to the plant?

A. No, sir. The flow of water to the plant?

Q. 219. Yes.

A. There is a safety gate in the forebay to maintain a proper level there at all times. That controls the water in the forebay.

Q. 220. At what point is it controlled?

A. From the power house.

Q. 221. In what manner?

A. The hydraulic engine.

Q. 222. How do you know from the plant what the level is?

A. A water gauge on the forebay.

Q. 223. How far is that from the plant?

A. That is 625 feet, approximately.

Q. 224. How do you observe it from the power plant?

A. Through a glass—a telescope.

Q. 225. And why is it advantageous to have this gauge at the forebay?

A. An excess of water would cause an overflow that might injure the plant.

Q. 226. How with respect to the pipe-line?

A. It would not affect it at all unless it would be to wash it out.

Q. 227. Is that part of the management and supervision of the power plant, namely, to keep tab on this forebay gauge through the glass and to regulate the flow past it from the power house?

A. Oh, yes. The operator in the power house takes care of that.

Q. 228. What is the primary method of controlling the butterfly valve, one for each unit in the plant at present?

A. A worm gear and hand wheel.

Q. 229. Is anything else used in this connection?

A. No, sir;—well, the same system is carried out through a system of bevel gears.

Q. 230. Is any sort of relief provided in the pipe-line today?

A. Yes, sir.

Q. 231. What is the nature of it?

A. A 12-inch hydraulic engine. A 12-inch gate operated by a hydraulic engine on the outside of the power house.

Q. 232. What controls that engine?

A. It is controlled by a hand lever at the switchboard.

Q. 233. Are there any other gates up the pipe-line or back of the butterfly valve of the three units?

A. Yes, sir.

Q. 234. What are they for?

A. They are to shut down and stop the water.

Q. 235. How are they operated?

A. The hydraulic engine.

Q. 236. By means of what?

A. Water.

Q. 237. What sort of control?

A. Hand control, and a lever at the switchboard.

Q. 238. If I understand you correctly, there are three separate hand controls, one for each of these gates, one for the forebay gate and one for the relief gate of the hydraulic engine.

A. Yes, sir; that is right.

Q. 239. Then in addition to that there are the three

hand-operated butterfly valves in the three distinct wheel units? Is that correct?

A. Yes, sir.

Q. 240. How many controls are there for each of these butterfly valves?

A. One to each, a hand wheel.

Q. 241. Is there any other wheel for controlling each of these butterfly valves between the main hand wheel and the wheel case?

A. Yes.

Q. 242. How are they operated?

A. Operated with a hand wheel by shafts and bevel gears.

Q. 243. Then I think I can sum it up correctly, and if I don't please correct me, when I say that I gather from your testimony that there are five hand levers and three separate pairs of hand wheels used in the control of this plant for its three wheel units at the present time. Am I correct?

A. Yes. A pair to each unit, one at each machine at the water-wheel case itself, and the other on the aisle in front of the switchboard.

Q. 244. In addition to the five hand levers?

A. Yes, sir. They are the hydraulic control.

Q. 245. And is it possible to properly and safely control and operate this plant at the present time without giving due attention to the hand operation of each one of these controlling devices?

A. No, sir; it is not.

Q. 246. Have you ever seen a hydraulic plant in which there was an automatic governor installed for

controlling the supply of water to the wheel case and for controlling the relief valves in the pipe-line?

A. No, sir.

Q. 247. If an automatically operating governor, such as that in kind or character, or with the object in view such as that attempted to be installed and operated in connection with the Girard water-wheel, were successful in use and operation, would or would it not be necessary to have these several sets of hand levers and hand wheels for the control of the supply of water to the wheels, to regulate the speed of the same, and also to take care of the pipe-line and protect it by a relief valve, and to have a man constantly in charge of these various hand devices?

Mr. Westall: Objected to as calling for matters of opinion which the witness has not been qualified to give.

Mr. Blakeslee: It has been shown by this witness what the purpose of the Girard installation was, and this question is predicated upon the witness's shown knowledge of that desired purpose.

Mr. Westall: The question goes further than that. It asks for matters of engineering theory, as to whether or not an air-chamber is required under certain conditions, and it calls for expert opinion of a man who has not had educational training as an engineer, and which might be even subject to differences of opinion among men most skilled in the art.

Mr. Blakeslee: We have not referred in the question to air-chambers at all, and the witness has shown his familiarity with the operation of an air-chamber, so far as that goes. We ask merely for a statement of fact

by the witness, based upon his experience with the Girard apparatus.

Mr. Westall: I would further state that the witness has shown that he has had absolutely no experience with anything but manual governors, except the original Girard governor, and he is not, therefore, qualified to state how far any governing which might properly be called successful governing would dispense with hand governing.

A. Just pay particular attention to how I answer this question. If the governing device supplied with each unit here by the Girard Water Wheel Company had filled the guaranty which guaranteed to give us for the regulation of the speed and safety, to the pipe-line—had it fulfilled these requirements, all this other trash would have been absolutely useless to the power house. Now you have got it as straight as I can give it. It is a question of absolute experience. I was up-against-it, and I know.

Q. 248. By Mr. Blakeslee: In order to take care of the various hand devices controlling the water wheels of this plant, including the Girard, Knight and Tuthill, were the services of one man in the power plant sufficient?

A. If it is automatically governed one man is enough.

Q. 249. How many did you use?

A. Two, all the time.

Q. 250. How long did each of these men work a day?

A. Eight hours each.

Q. 251. How many of the twenty-four hours was the plant operated?

A. Full time, twenty-four hours. Three shifts of 8-hours each.

Q. 252. One man for each shift?

A. Two. Two men on duty all the time.

Q. 253. That is, one of these two men had as his duty to attend to the hand-operating devices?

A. All the time.

Q. 254. What was he paid a month?

A. Well, their wages ran about from \$60 to \$75. The foreman of the power house got \$75 and the balance got \$65, and later on they got \$70. The scale of wages changed with years. The second man in the power house got \$60.

Q. 255. That would be in round figures \$190 to \$200 a month for the extra men?

A. Not that much. Yes, it would be pretty nearly that much.

Q. 256. And that was the case all the way along with this plant?

A. All the time. After we got operating we found that we had to have two men. At the start I operated myself for some time alone, but it was not possible to do it.

Q. 257. Was it ever necessary for you to be advised or informed as to the load conditions at a distance on your circuit before attending to the governing of the wheels?

A. Yes; invariably.

Q. 258. How was that done?

A. By telephone.

Q. 259. Was that true in using all three types of wheels mentioned?

A. Yes, sir; whenever we attempted to use a governor.

Q. 260. Suppose you had not been so informed and a big load came on, such as starting up a 50 or 100 horse-power motor?

A. It would result in shutting down from fifteen to twenty-five pumping stations that the Kern County Land Company was running for their City Water Works. It would shut them down unless it was controlled by hand properly.

Q. 261. Did you ever have any trouble with this hydraulic-engine-operated and hand-controlled relief valve on the outside of the plant?

A. Yes.

Q. 262. What sort of trouble?

A. Well, that would require a little explanation. That gate was set to go up and open the full 12 inches in about 10 seconds, to relieve the pipe-line immediately, before the other gates could get closed down. Then the instructions were also in closing that gate to do it by hand—shutting off by hand—with the other gate which is right on top of the pipe-line between the hydraulic engine and the pipe-line, to shut that by hand and shut it slowly, so as not to cut off that 12-inch stream and produce a shock to the line.

Q. 263. That was an extra valve?

A. An extra gate on top of the pipe-line between the hydraulic engine and the pipe-line.

Q. 264. That is still there today?

A. Yes. The trouble we had, one night one of the men who was a new man and not well posted, got a little excited, and they had to shut down, and they had to

throw that valve open. He went and closed it with the hydraulic engine, putting it down about as quick as it went up, and the result was it blowed the whole side of the gate out and lifted a 500-gallon steel tank about 60 feet away from the power house. That was the result of the shock to the pipe-line. So we had a little experience with pipe-line shock.

Q. 265. About how long was your pipe-line or penstock at that time in which such ram would occur?

A. The pipe-line running from the receiver, as we call it here, to the hydraulic engine, was a very short piece of pipe—not over 3 feet long. After the blow-~~out~~^{up} I put in that extension.

Q. 266. How long was your penstock back of that?

A. That is 625 feet long.

Q. 267. About what is the angle of inclination of that, if you know?

A. Something like 35 degrees. That is, where it raises here.

Q. 268. When you found the governing apparatus and by-pass device of the Girard installation was failing to give satisfaction, and you had to repair it and to replace breakages, did you call in anybody to consider the matter from an engineering standpoint and attempt to correct the troubles?

A. We had our hydraulic engineer here.

Q. 269. Who was that?

A. Edwin S. Cobb. We had B. C. Van Emon, superintendent of the company that furnished us with the material.

Q. 270. What did they do or try to do?

A. They attempted to adjust it and get it to operating properly.

Q. 271. And was it this Mr. Cobb who also experimented with the attempted by-pass in connection with the Knight wheels?

A. Yes, sir; he designed it.

Q. 272. Was Mr. Cobb here in connection with attempting to operate that last form of by-pass device?

A. He certainly was.

Q. 273. What kind of a valve was that last by-pass?

A. It is the one that is now sealed up in the power house.

Q. 274. Was it of the sliding type or the butterfly type?

A. It was of the sliding type.

Q. 275. Did you know any of the other officers of the Girard Water Wheel Company?

A. No, sir; I did not. I never had the acquaintance of anyone connected with them with the exception of Mr. Van Emon and Mr. Berry, who was a draughtsman, as I understood, in their employ. Those were all the employees I knew of connected with them.

Mr. Blakeslee: Counsel may cross-examine.

CROSS-EXAMINATION.

By Mr. Westall:

XQ. 276. Mr. Dearth, prior to your connection with this power plant you had never had any special mechanical or electrical education, had you?

A. Not along electrical lines; no sir.

XQ. 277. And you never had any technical education along mechanical lines, had you?

A. No, sir.

XQ. 278. Your experience prior to your connection with this plant had been in the carpenter business, had it not?

A. Part of the time.

XQ. 279. And when you were first connected with the plant in 1895 you came here as a carpenter?

A. Yes, sir.

XQ. 280. How long did you work here at this plant as a carpenter before the machinery was installed?

A. From December, '95, to—well, practically a year or fourteen months before we got the machinery in operation; perhaps fifteen months.

XQ. 281. When was the machinery first put in operation?

A. We made a trial run of it in June of—These dates is what gets me—in June, 1897.

XQ. 282. Who was in charge of the plant at the time that first trial was made?

A. I was in charge of that here at all times.

XQ. 283. You were employed as a carpenter and also as superintendent of the mechanical and hydro-electrical features of the plant?

A. I was put in as superintendent of construction, and did superintend the general camp outfit here all the time.

XQ. 284. Did you direct how this machinery should be installed in the plant?

A. No, sir.

XQ. 285. Did you have anything to do with the

planning or with the estimating or the decision as to what kind of machinery should be placed in the plant?

A. No, sir.

XQ. 286. At that time you had no sufficient training or knowledge to enable you to do that intelligently? Is not that true?

Mr. Blakeslee: Objected to as calling for a conclusion. Let the witness testify as to what his qualifications were, if counsel wishes him further to do so.

A. Yes.

XQ. 287. By Mr. Westall: So that your position as superintendent was mainly that of looking after the carpenter construction and taking charge of the camp generally in a supervisory capacity, rather than in a mechanical way. Is that true?

Br. Blakeslee: Objected to as calling for a conclusion on the part of the witness, and an expression of opinion, and not for a statement of facts of what he did or was here to do.

A. That is true; yes, sir.

XQ. 288. By Mr. Westall: And at that time you did not know anything about governors or water-wheels. Is that true?

Mr. Blakeslee: Objected to as indefinite as to time.

XQ. 289. By Mr. Westall: I mean in 1895 at and prior to the first test operation.

A. That is the way I understood the question. I knew nothing about it. (The question is read by the Examiner.) It is true.

XQ. 290. Who was in charge of the mechanical work and by that I mean the installation of machinery in the plant, at the time last referred to?

A. There were three men in charge of that, each one in his respective department—electrical, hydraulic—two men, electrical, hydraulic and on water-wheels.

XQ. 291. Will you please mention each of those men and state what particular department each had in charge?

A. Edwin S. Cobb was hydraulic engineer in charge of the installation of the pipe-line and supervision of it, and other things pertaining to the plant up to the water-wheels. B. C. Van Emon was in charge of the installation of water-wheels and governors. Mr. Lighthipe was in charge of the installation of electrical machinery and switchboard. He was assisted by his brother-in-law, and I cannot recall his brother-in-law's name.

XQ. 292. Will you please describe in a general way the tests that were made just after the installation of the machinery and say how long a period those tests extended over?

Mr. Blakeslee: Objected to as not cross-examination, no foundation laid, the witness not having testified that he had anything himself to do with the tests.

A. That covers a wide scope of territory. It involves a good deal. It involves tests of the hydraulic installation, pipe-line, forebay and everything pertaining to it, and the flume, and tests of the water-wheels and their efficiency, tests of governors and their efficiency, and operation tests of the electrical installation, generators, transformers, transmission lines, and everything pertaining to them, clear to the other end of the line. It is a long job.

Mr. Blakeslee: We ask that the question and answer be stricken out and withheld from consideration on each

of the grounds stated in the objection to the question.

XQ. 293. By Mr. Westall: When was the water first turned into the pipe-line for the purpose of making any kind of a test?

A. I could not give you the date.

XQ. 294. Approximately when?

A. Sometime in June of 1897.

XQ. 295. And was water flowing through that pipe-line continuously thereafter?

A. No.

XQ. 296. When again was water, after being turned into the pipe-line, shut off?

A. Well, there was a test made of the pipe-line, and then it was emptied very shortly afterwards for the purpose of remedying defects which appeared, and turned in again, and an attempt made to start the machinery and defects appeared which made it impossible to do it at that time, and it was shut off and the pipe-line emptied again. No wheels had turned up to this time, you understand. There was no water turned onto the wheels. After these defects were remedied, which took considerable time and involved the walling-in of this pipe line from here to the top of the hill,—it laid on top of the ground and we had to wall it in; the vibration was too great for it. Then we turned the water in again.

XQ. 297. When was this done?

A. Sometime in June or July.— This was going on in June, July and August of that year. Then we commenced to turn the wheels over and making the tests of the water-wheels, governors, electrical apparatus and everything.

XQ. 298. And for how long a period did those tests

of the apparatus that you have mentioned continue?

A. They must have lasted at least two weeks

XQ. 299. And when was that?

A. In June or July of that year. I could not give the exact date.

XQ. 300. These tests continued until sometime in August, 1897?

A. I think so.

XQ. 301. After August, 1897, was the water allowed to run through the pipe-line to a degree that might in any way or in any sense be called continuously?

A. Yes. We got started and tried to run.

XQ. 302. Now, there was a great deal of trouble with various parts of the apparatus which developed during the taking of these tests during the months of June, July and August, wasn't there?

A. Quite a good deal; yes sir.

XQ. 303. And it was discovered that the Girard wheel that was put in did not develop the horse-power that was estimated? That was true, wasn't it?

A. Yes, sir.

XQ. 304. And there was a great deal of figuring for a long time after that to discover what was the matter, wasn't there?

A. Not a very long time. On the second test, I think it was, they gave it up as being an impossible thing to reduce the result to ~~the~~^a guaranty. The company immediately negotiated for other wheels.

XQ. 305. And it was found that the Girard wheel was inefficient and would not produce the results that had been aimed at?

A. It was.

XQ. 306. And that was one of the reasons why the Girard wheel was removed and a Tuthill wheel substituted?

A. That was the reason.

XQ. 307. Now, with the substitution of the Tuthill wheel, the Girard governor was still retained?

A. Yes, sir. Not in the same position. Not all of it located as it was with the Girard. That was a different installation.

XQ. 308. Now, at the time about which you are testifying, namely, in June, July and August, in the latter part of 1897, you did not fully understand what was the matter, did you?

A. No.

XQ. 309. It is a fact, is it not, that even the engineers in charge did not thoroughly understand just what was the matter during the test, and it took a great deal of experiment and time to understand what these defects were caused by?

Mh. Blakeslee: Objected to as being a double question and calling for two answers. Furthermore, it is objected to on the ground that it is indefinite and calling for a conclusion of the witness as to the opinions of other witnesses, and therefore not proper testimony and not the proper method of proof.

A. That is two questions. The first one, I know nothing about what the engineers thought or what conclusions they came to, or what they thought they were up against. As to the latter part of the question, they consumed a great deal of time in experimental work. There was not very much experimental work done along that line.

XQ. 310. By Mr. Westall: But at that time you did

not know what the defects were? Such knowledge as you now possess has been acquired since that time?

Mr. Blakeslee: Objected to as indefinite and as merely argumentative and not calling for a statement of facts and as being a double question.

A. I only knew what the results were. That is all. (Second part of question read by Examiner.) Yes, sir; beginning with that time.

XQ. 311. By Mr. Westall: What kind of a governor was used with the Tuthill wheel that was put in when the Girard wheel was taken out?

Mr. Blakeslee: Objected to as merely repetition. The witness has already fully testified to that.

A. The governor was the same. The application of it was different.

XQ. 312. By Mr. Westall: And how was the amount of water that was propelled against the buckets of the wheels governed in the Tuthill wheel?

A. By a deflecting plate sliding over the nozzles.

XQ. 313. Now, with that kind of a method governing, the by-pass which had previously been used with the Girard wheel was not necessary?

A. Not at all. That was abandoned long before.

Mr. Blakeslee: Objected to as calling for a conclusion.

XQ. 314. By Mr. Westall: And the reason that it was abandoned was because a new method or a new principle of governing had been adopted in its place?

Mr. Blakeslee: Objected to as calling for a conclusion, not the proper method of proof, and not calling for a statement of facts.

A. No.

XQ. 315. By Mr. Westall: Is it your understand-

ing that with the deflecting nozzle that the by-pass is needed ?

A. It is not.

XQ. 316. And so it is true, then, that when the deflecting nozzle of the Tuthill wheel was used, it made the by-pass no longer necessary in the governing?

A. That was not a deflecting nozzle. It was simply a steel plate passing in front of the nozzle.

XQ. 317. That is what I mean. But it is something of the same form?

A. Yes, sir; the effect is the same, practically.

XQ. 318. Now, you have stated the Tuthill wheel was replaced by a Knight wheel.

A. Yes, sir.

XQ. 319. What kind of a governing apparatus was used with this Knight wheel?

Mr. Blakeslee: Objected to as being repetitions and having been answered before.

A. The same. It was a Girard governor.

XQ. 320. And how was the amount of water that was propelled against the buckets of the wheel regulated?

A. That is a pretty hard question to answer, because it involves a description of the mechanical device which the engineer who designed it did not seem to be able to name himself. It consisted of two rings in the shape of a tee-iron which closed over the nozzle to open and shut. It was operated by a system of bell-cranks inside of the water-wheel case, and they were actuated by this same hydraulic engine that the Girard Water Wheel Company put in, only it was located in a place convenient for that operation.

XQ. 321. When the water was shut off from being propelled against the buckets of the wheel in the device about which you have just testified, what became of the surplus water that was then shut back into the penstock?

A. There was a by-pass provided to take care of that water.

XQ. 322. And how was that by-pass regulated?

A. It operated from the hydraulic engine in unison with the operation of the controlling plate inside of the water-wheel gate.

XQ. 323. Was that under the control of this Girard governor at that time?

A. Yes, sir.

XQ. 324. And how long was the Girard governor used in that connection with this Knight wheel?

A. Not to exceed fifteen minutes.

XQ. 325. After its use was discontinued what did they do with the surplus water that was shut back into the penstock when it was shut off from being thrown against the buckets of the wheel?

A. This butterfly valve was introduced at that time in the Knight water-wheel which is now controlling the plant and has been ever since. A man was placed right here to handle it. We hired an extra man and put him on there to take care of it. The handle was worked by hand then entirely.

XQ. 326. And since that Knight wheel has been put in this method of manual operation has been retained continuously all during the time you were connected with the plant?

A. No, sir. I understand your question since the

time that this last device broke down in about fifteen minutes?

XQ. 327. Yes.

A. No, sir.

XQ. 328. What kind of a governing apparatus was used after that? Or describe just how the governing apparatus had been changed.

A. It was a scheme devised by Mr. Beal. He was very anxious to get some kind of a governing device on the wheels and we manufactured it, installed it and put it on, but operated it with the Girard water-wheel device and the same hydraulic engine. Then we installed the safety valve.

XQ. 329. Will you please describe the last device which you say was originated by Mr. Beal?

A. It is a pretty hard thing to describe. The nozzle block that operates the Knight wheel is about, pretty nearly, a half circle. It is divided into six square ports, and the wheel runs very close to that nozzle block. Mr. Knight claimed that it was part turbine in its effect--pressure as well as speed. They cut away that nozzle block just enough to introduce a bronze plate which was cast on the same circle as the nozzle block, and they operated by bell-cranks similar to Cobb's device, on the inside of the water-wheel case, by the same hydraulic engine and system of bell-cranks back to the dynamometer in the fly-wheel. That would open and close and shut off the volume of water.

XQ. 330. That plate that you have described operated to shut the water from being propelled against the buckets of the wheel in substantially the same manner

that the previous device that you have described did?

A. That is right.

XQ. 331. And how was the excess of water which was thus shut back into the penstock disposed of?

Mr. Blakeslee: Objected as indefinite.

A. We took our chances on a wreck. That was all there was to it. In plain words, we risked it.

XQ. 332. By Mr. Westall: And how long was this new method of governing used?

A. I think, if I remember right, it was about four or five months. We only had two machines in the power house. Before we put the third wheel in we abandoned the whole business entirely and used hand control, and put on the safety valve on the pipe-line.

XQ. 333. In what year?

A. That was in 1898 when they put the Beal governor on, according to my recollection.

XQ. 334. And about what time of the year were the four or five months that you have mentioned?

A. Well, it was the latter part of the year, I think.

XQ. 335. At the expiration of those four or five months, what kind of governor, or what kind of governing, was attempted?

A. Nothing. The men governed it and hand-controlled it.

XQ. 336. And so, since the latter part of 1898 or the early part of 1899 there has been no governing attempted other than the manual means that you have described?

A. That is right.

XQ. 337. And it has been found that such governing was adequate for all purposes of this plant?

Mr. Blakeslee: Objected to as calling for a conclusion

of the witness and not for a statement of facts, and being a statement of opinion.

A. It was not.

XQ. 338. By Mr. Westall: Would you say that such method of governing has been unsatisfactory?

A. Yes, sir.

XQ. 339. And during the time that this hand governing that you have described had been used, you say that the company has been expending on an average of \$180 or \$200 a month extra that it would not be required to expend if it had an adequate automatic governor?

A. It would do away with the services of one man continuously, or three men.

XQ. 340. And would save that amount of money?

A. Yes, sir; it would be three men out. That is demonstrated here right now. They run the plant with one man right along.

XQ. 341. Isn't it a fact that there has been no occasion for very strict or careful governing of the water-wheels of this plant?

A. No. We need the best government in the world for efficient service.

XQ. 342. Isn't it true that during the time that you have been connected with the company that the loads imposed have been very uniform?

A. No. That is a hard proposition.

XQ. 343. Is there at the present time any means connected directly or indirectly with this plant for automatically governing the speed of the water-wheels?

A. Only remote.

XQ. 344. Will you please describe such remote means?

A. This plant is tied in with two other plants, the steam plant in Bakersfield which has a third higher capacity than this, and a power plant above Fresno—the Crane Valley plant, I think it is—which has four times the capacity of this. The rule of practice is that the plant with the highest available power controls the whole thing. The man at the Crane Valley switchboard handles this as well as the man here. This is controlled absolutely by them.

XQ. 345. And it is true that this remote control that you have spoken of makes it possible to dispense with automatic governing which would not be possible if this plant were isolated?

A. That involves a good deal more than a simple answer of yes or no.

XQ. 346. But you would say, would you not, that this is an important factor in the determination of whether or not an automatic governor should be used here?

A. I will answer that by saying that it is an important factor in the governing of the system. That involves a good deal more than yes or no. The answer is good for when they are both on the line.

XQ. 347. So that if those plants were cut out it would require very great care and attention to prevent trouble, or to prevent injury to the pipe-line here, would it not?

A. There would be more danger of disorganizing your service.

XQ. 348. And from your long connection with this plant, would you not say that the fact that this plant is connected up with the other two plants that you have

mentioned, is one of the reasons why a modern governing apparatus has not been installed?

A. That is something I know nothing about. My interest in the company passed out with my resignation, and I don't know anything about what reasons they have for doing what they are doing.

XQ. 349. But prior to your severing your connection with the company you were in touch, to some extent, were you not, with the policy which declined to avail itself of the latest modern improvement?

Mr. Blakeslee: Objected to as stating a conclusion and calling for an expression of opinion, indefinite, and not calling for a statement of fact.

A. Do you mean the present company?

XQ. 350. By Mr. Westall: I mean the company that you were working for.

A. That I understood their policy of not installing something here?

XQ. 351. Yes.

A. My impression always was that they got pretty badly discouraged with the expense and the disappointments, and they concluded that they better stand the expense of the extra men than the expense of putting in another installation and trying it out and meeting with some such a result with which they had already met. That is what I concluded, if you want my conclusion. That is a long way to answer the question, but that is what I thought they had in mind.

XQ. 352. So that you believe the experience that the Power Development Company had with the Girard wheel and with the Girard governor that you have described, has been the cause of the failure of the Power

Development Company, and the Power, Transit & Light Company, to avail themselves of modern governing means?

A. I will say my knowledge of the company's policy and their inclination in this matter was that they anticipated disposing of the plant, and that they were satisfied to try and get along with what they had and not incur any further expense.

XQ. 353. So that you do not believe that the experience the Power Development Company seventeen years ago with an automatic governor has been the only and sole reason why they have not put in an automatic governor since that time?

Mr. Blakeslee: We object to this question and this line of questioning, as not calling in any respect for a statement of facts. We are not concerned here with the mere belief of this witness as developed on cross-examination, but we want to have from him a statement of fact as to what is within his knowledge. His belief, unsupported by a statement of fact, is not proper testimony in the case, nor is it in any case.

A. That is a question that I won't try to answer, because I never considered anything of the sort.

XQ. 354. By Mr. Westall: You were not close enough in touch with the management of the company to have any knowledge for the reasons of the policy which prevented them from availing themselves of the modern improvements in governing apparatus? Is not that true?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts, not the proper method of proof and not cross-examination. The witness testi-

fied that he was superintendent of this plant for a great many years, and his testimony should concern his experience and knowledge only from such position as superintendent and any of the work he did in and about this plant.

Mr. Westall: It is submitted that the question calls for the relation of the witness to the management of the company and to the operation of the plant, and the reason why certain apparatus was not installed, and that the witness has testified very fully on direct examination concerning those same things.

Mr. Blakeslee: The witness can only testify by stating questions of fact as to the duties he performed, in the position or positions he filled. Aside from that, he cannot state competently what the policy of some other official or officials was, which officials had their own spheres of activity apart from him, and the proper method of proof would have been to have called such officials while they were taking their other proofs pertinent to this plant.

Mr. Westall: If he has testified that automatic governors were taken out, and he has suggested why they were taken out, it is perfectly competent to inquire further what other reasons there may have been for not installing or keeping such governors, and the question is merely directed to bring out that additional knowledge.

Mr. Blakeslee: If that is true, let the question be asked of the witness what other reasons there were. That is, what other reasons might have come within his knowledge. It is not proper to ask this question as to what other reasons in these respects there may have been within the operation and thought and plant and

policy of some other official or officials of this company.

A. No; I hardly think that is true.

XQ. 355. By Mr. Westall: So that you consider that you are fully acquainted with all of the reasons which prevented or governed the actions of those in control of the company in neglecting to avail themselves of any form of efficient automatic government. Is that correct?

Mr. Blakeslee: The same objection.

A. No. I don't know all their thoughts and business, by any means.

Mr. Blakeslee: We ask that both this question and the last previous question and answers to each part and parcel thereof be stricken out and withheld from consideration, on each of the grounds just urged to these questions.

XQ. 356. By Mr. Westall: Then you would say there may have been important reasons other than alleged inefficiency of this old Girard governor, which have influenced the actions of those in charge of the company, in refraining from using any method of automatic governing since that time. Is that true?

Mr. Blakeslee: Objected to as merely argumentative, not the proper method of proof, not calling for a statement of facts, and merely calling for a wide guess. And, furthermore, that it is indefinite and not cross-examination.

A. I think I answered that question a while ago in the only way that I can possibly answer it. You will find it back there, that they thought it cheaper to maintain the plant the way they were running it than to in-

stall something and meet up with the disappointment that they had already met up with.

XQ. 357. By Mr. Westall: Then you believe financial reasons may have had considerable weight in determining the action of the company in refraining from availing themselves of the latest modern governing apparatus?

Mr. Blakeslee: Objected to as indefinite and not the proper method of proof and not calling for a statement of facts, but merely for a statement of belief, which, when unsupported by a statement of facts, is not competent testimony, according to all rules of evidence.

A. No, sir.

XQ. 358. By Mr. Westall: Then the only reason that you can give for the failure of your company to use the Girard wheel and governor? Is that correct?

Mr. Blakeslee: Objected to upon each of the grounds urged against the last several questions, and as being merely repetitious. Furthermore, that it is not in accordance with the testimony previously given by this witness, and is misleading, and is not the proper method of proof.

A. No.

XQ. 359. By Mr. Westall: Do you believe that those experiments of seventeen years ago have had any weight in determining the course of the company with which you were last connected in refraining from using some form of automatic governor?

Mr. Blakeslee: The same objection, and that it is merely repetitions, and we call the attention of the court to the fact that we have warned counsel in our objection not to deal with this witness as to matters of mere

naked belief unsupported by facts. And if counsel persists in this line of cross-examination, we move that the cost of taking and returning this deposition, or, at least, the cross-examination thereof, be taxed against the defendant, it being merely incumbering the record and improper. This is the rebuttal case and not the defense case.

A. Well, that is a pretty hard question to answer. I think I understand the situation pretty thoroughly why the company has never attempted to put any other governor in, and I think I have explained that as far as I understand it. Of course, you understand that the experience we went through with was educational. They discovered a great many things that they possibly did not know when they started in, and, among others was that this was a plant of its own, with its own peculiarities, and not to my knowledge has anybody ever offered to install a governor here that they thought would do the work since. They possibly may have done it. The question has never come up in my presence, and I never have asked the company to install a governor, and my experience was so very discouraging, and when I say "discouraging", I say emphatically that it was.

XQ. 360. By Mr. Westall: And your early experience was such that you became convinced that automatic government of any kind would be a failure?

A. No, sir. I am too progressive for that. There is not any such thing as that in my vocabulary.

XQ. 361. Do you believe that those connected with the company had any such ideas?

Mr. Blakeslee: We again object to this question as not the proper method of proof, not calling for a state-

ment of facts, and that the parties who are concerned are not here to testify, and that the defendant had his chance to get them to testify, if it wished or dared to.

A. I couldn't express what my belief would be in reference to the company's ideas.

Mr. Westall: It is submitted that this witness testified that he had the management of this plant for a great many months. Having the management of the plant, it is certainly competent and proper for him to testify why certain apparatus was not used or why it was used. He has partially done that on his direct testimony, and the present questions are directed merely to bring out those additional facts more clearly.

Mr. Blakeslee: There are only certain facts which any witness can testify to, and those are the facts within his knowledge. The witness may believe that there is a heaven and that he will go to it, but he cannot testify about any such heaven here.

XQ. 362. By Mr. Westall: Were any of those who were connected with the company in 1897 and 1898 connected with the company at the time you severed your employment with it?

A. None that I was acquainted with had anything to do with it.

XQ. 363. So that any of the discouragements that may have come to you in 1898 were communicated to the persons who were subsequently interested in the company and operated to discourage them as well as the former owners. Is that correct?

Mr. Blakeslee: Objected to as merely stating a conclusion and not asking a question, and not the proper

method of proof, indefinite and vague, it not being known how a discouragement could be communicated.

A. You have got me into a question there that is impossible for me to answer. The only change in administration that occurred from 1898 up to the time my resignation went in was with the general manager in Bakersfield. Mr. Beal resigned, and a gentleman by the name of Goodwin succeeded him in the management of the business affairs of the company. This was a part of it—the operation. Mr. Goodwin died and Mr. Harry Jastro succeeded him. There is no use my talking to you about things that I don't know or things that I do know but cannot swear to. The power behind the throne, I know who that was from hearsay; but the manager here had nothing to say about any improvements, or anything of that kind, concerning this plant, whatever. He simply took hold of what was here and operated it as it was to the best advantage.

XQ. 364. By Mr. Westall: Now, in 1897, when the water was first turned into the penstock, what were your particular duties?

A. I had charge of everything. I might substitute that by saying that I was superintendent. That covered the whole thing.

XQ. 365. Was it part of your duty to consult with Mr. Cobb and Mr. Van Emon and others who were planning the installation of machinery, as to what machinery should be used, and as to how it should be assembled for any of that work?

A. Each one of those men came here with their devices to install them, guaranteeing certain results, and I had nothing whatever to do with them only to see that

they were comfortably housed and fed, and had all the labor they needed.

XQ. 366. And during those tests of the Girard wheel and the Girard governor you continued to perform those same duties?

A. I was superintendent.

XQ. 367. And so that with your education and training and experience with things mechanical and hydraulic and electrical, you did ^{not} know and did not attempt to pass judgment at that time upon the efficiency of the various apparatus which were being tested, did you?

Mr. Blakeslee: Objected to as indefinite with respect to the use of the word "efficiency." The witness testified that he was superintendent and that he observed the results of the apparatus. With such testimony we insist that the use of the word "efficiency" coming within the knowledge of the witness, the question should be more specific.

Mr. Westall: The word "efficiency" has been used several times during the course of the examination, and it is a word in common use, and I believe the witness thoroughly understands its meaning.

A. I was thoroughly conversant with the contracts for the different apparatus, hydraulic and electrical, and what they were expected to do, and the only knowledge I have was the result we got from the test.

XQ. 368. By Mr. Westall: But at that time you had no means of comparing those results with results of other plants?

A. No, sir.

XQ. 369. And so at that time you did not know

whether the work was progressing favorably or otherwise, did you, except what you heard from hearsay from stray remarks of the engineers and others during the progress of the work?

Mr. Blakeslee: Objected to as indefinite and calling for a conclusion.

XQ. 370. By Mr. Westall. I am talking about your knowledge, since you may have gained a good deal of knowledge since that time. I mean your knowledge at that time.

A. You are getting into a technical part of this which I cannot swear to at all. I had a superficial knowledge of what to expect; that is, I knew the pressure on that pipe-line, the spout velocity of the water and the result it should give on the wheel. I knew the rated capacity of the generators, the power that was applied to them and what result we could expect from them. I knew the range of variation that speed would give, and I knew what we ought to expect of the regulation of the speed in order to maintain a certain voltage without too much variation. That part I have learned. I have studied it up to learn it. No engineer told me. I have text-books here and figured it out myself.

XQ. 371. You studied that before the water was turned in to the penstock?

A. Yes, sir. I did not have much knowledge, but those few simple facts I acquired so as to know where I was getting off at.

XQ. 372. And during all this time you were superintending the erection of the buildings and housing of the men?

A. Yes, sir.

XQ. 373. How much time did you spend in the plant during the tests?

A. During the tests I was in the plant all the time. The construction work was completed.

XQ. 374. The reason the Girard wheel was taken out was because it did not develop the required horsepower?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts.

A. Yes, sir; that is the reason.

XQ. 375. By Mr. Westall: And it is also true that when the new wheel was put in it had a method of governing which did not require the use of a by-pass. Is that true?

A. When the Tuthill wheel was put in; yes, sir.

XQ. 376. Did you take actual charge of the building of the various sheds and houses adjacent to this plant?

A. I did.

XQ. 377. How long did it take you to build the bridge you speak of, half a mile below the power house?

A. We were about five or six weeks on that.

XQ. 378. That was in 1895?

A. Well, we commenced it the day before Christmas, 1895, and finished it up in 1896.

XQ. 379. And after that time were you engaged in putting up buildings in or near and adjacent to the plant a good deal of the time?

A. After the bridge was completed we commenced delivering lumber here for a flume. We had a camp of probably eighty or ninety men in the camp working at rock work, putting up the power house site. I had thirty

or forty men shooting out rocks for the power house and room for the cottage, and building the flume, and delivering the lumber up there and hauling it up on the hill, to get everything equipped so as to handle it nicely.

XQ. 380. How long did you work at that?

A. We finished the flume in October of that year.

XQ. 381. 1895?

A. 1896.

XQ. 382. Then what construction work were you engaged in?

A. We finished the power house about a month later. Of course, you understand that I did not do this work. I had a set of plans drawn by a mechanical draughtsman, and I just hired the men and put them at it and saw that they did the work. I was not around here working with tools at that time at all. I was superintending the work.

XQ. 383. And how much of the time did you spend at the various buildings in superintending the work of the men?

A. I spent probably nine hours of my time a day.

XQ. 384. How long did that continue?

A. That continued from the time I commenced that bridge until the power house was completed.

XQ. 385. When was the power house completed?

A. In the fall of 1896.

XQ. 386. So that at the time they commenced the installation of the machinery and apparatus all the buildings that are now on the property had been constructed?

A. No; not all of them.

XQ. 387. And during the making of those tests were you engaged in any other building operations?

A. No, sir.

XQ. 388. You had completed all those operations?

A. Yes, sir.

XQ. 389. How did you spend your time after the completion of those buildings?

A. Operating the plant when they got started. When they were installing I was right with them all the time. While I was working nine hours a day here on an average and perhaps a good many days ten in the construction work, I was spending four or five additional hours studying up hydraulics and electricity. So I put in about fourteen or fifteen hours a day right straight through.

XQ. 390. How much time did you put in in studying electricity before they first let water into the penstock?

A. Oh, it was probably a year that I had taken the study up.

XQ. 391. And out of that time had you put in five hours a day study?

A. Averaged that; sometimes more, and perhaps sometimes less, but it was about five hours.

XQ. 392. That is, you worked nine hours and put five hours more in, which would make fourteen hours?

A. We did not have union rules here then.

XQ. 393. And the rest of the ten hours was spent in rest and recreation?

A. Yes. There was no recreation about it. You can leave that out.

XQ. 394. You have described or mentioned a butterfly-valve used with the Knight wheel. How long was that butterfly-valve used after it was first adopted?

A. It was used all the time, ever since the wheel was installed.

XQ. 395. And was it used up to the time that you severed your connection with the company?

A. Yes, sir; it is in use there yet.

XQ. 396. You have stated the company has been expending between \$180 and \$200 a month for extra help to operate the manually controlled apparatus.

A. We employed three extra men, and their average wages would be \$65. You can figure that up to suit yourself.

XQ. 397. And you have also testified that if an efficient governor had been employed, or if the Girard governor had met the expectations, it would not have been necessary to employ these extra men or expend this extra money.

Mr. Blakeslee: We object to counsel reciting the testimony as he has in the last question. If that is the testimony, it is. If counsel wishes to cross-examine in regard to the testimony, let him do so. It merely incumbers the record.

XQ. 398. By Mr. Westall: Is it your understanding that those in charge of the company have been expending this money all these years because of the discouragements that they received while experimenting with this old Girard governor?

Mr. Blakeslee: Objected to as repetitious and not calling for a statement of facts, not the proper method of proof, a mere statement of the witness's opinion, the witness not being competent to testify as to what was in the minds and in the policies of other officials.

A. I could not tell you what was in the minds of our managers.

XQ. 399. By Mr. Westall: Did you ever recommend the adoption or installation of any form of automatic governor?

A. No, sir.

XQ. 400. Did you ever have any conversations with any of those in charge of, or having the management of, or who might influence the management of the company, respecting the installation of some form of automatic governors?

Mr. Blakeslee: We object to this question as being grossly a violation of the laws of evidence, it not being shown that as to any such purported conversation either of the parties to the suit were present.

Mr. Westall: I am asking him if he had any conversation.

A. No, sir.

XQ. 401. So that during the seventeen years since you tried that Girard governor, there has never been any suggestion by you or to you as to the employment of any form of automatic governor?

A. No suggestion been made ~~by~~ me, and as to being made to me, I have no recollection of anybody approaching me on the subject.

XQ. 402. As superintendent of the plant, were you not vitally interested in giving the most efficient service and protecting the pipe-line in every manner that could be devised?

A. Certainly.

XQ. 403. And knowing that automatic governors would give better and more efficient service, you did not

consider it worth while to take it up with any of the managers of the company?

A. No, sir.

XQ. 404. Will you please state any reasons that you may have for not taking up a matter of such vital importance with those who had charge of the management of the company and to whom you were responsible for the efficient and safe operation of the plant?

Mr. Blakeslee: Objected to as not cross-examination of the witness, it not having been shown that he had anything to do with the advising of the installation of the plant, no testimony being given but that he was superintendent of the plant to run it with the apparatus that was given him. Therefore, no foundation has been laid for the question, and it is not the proper method of proof.

A. I cannot recall any reason now that would answer that question.

XQ. 405. By Mr. Westall: Did you keep any books relating to your duties as superintendent and the payment of moneys necessary to be made in the operation of the plant?

A. I kept a time-book of my employees and who my employees were, the log book in the power house in the operation of the plant, reading of the instrument, temperatures, the weather, rainfall, and everything of that kind. That is all the books I was required to keep.

XQ. 406. Did you ever have any discussion with any of those in charge of or to whom you were responsible in the management of the company about this \$180 or this \$200 which was being paid to these extra assistants?

A. No, sir. That I left entirely in their hands.

XQ. 407. So you did not consider it part of your duties as superintendent to advise those in charge of the company that they might save something like \$180 or \$200 a month by the employment of an automatic governor?

Mr. Blakeslee: Objected to further on the ground that no foundation is laid for the question, it having been shown by the testimony of the witness that as to all these matters relating to the control of the plant, aside from his superintendence, there was a general manager of the plant, one Beal, and the defendant should have called that general manager if he wanted to know why the general manager did or why he did not do certain things.

A. I never felt it was my duty to inquire into the policy of the management of my company. That matter was entirely in their hands.

XQ. 408. By Mr. Westall: So that your duties were simply to obey the directions of some person higher up in the company?

A. I was operating under orders all the time.

XQ. 409. And your advice as to the efficiency of the machinery or the expenditure of money for maintenance was never sought by the company?

A. No, sir.

XQ. 410. And you did not pose at any time as one competent by education or experience to advise with the management as to the efficiency of the wheels or the other parts of the machinery or as to the financial management of the company?

Mr. Blakeslee: Objected to as calling for a mere

statement of conclusion on the part of the witness, based upon supposition as to the posture of this witness. What his posture was and what he did and what he knows are separate things, and his posture has nothing to do with this case.

A. The company had an efficient engineer. They were evidently capable of taking care of their own finances, and I considered I had all I could do here and I didn't bother myself a particle about their engineering department, or the expense of operation, as long as I did not hear any complaint from them coming up to me.

XQ. 411. By Mr. Westall: So that you cannot say, having no means of knowing, why the company did not install some form of automatic governor?

A. No, sir; I couldn't tell that.

XQ. 412. And you do not know that the early failures, as you have described them, of the Girard wheel or the Girard governor, had anything to do with the failure of the company to install some automatic form of governor. Is that correct?

A. I don't know anything about that; no, sir. I had no means of knowing it, and I was not in their confidence.

XQ. 413. Now, during the testing of the plant in 1897 and during the time the Girard water-wheel was being tried, you, as superintendent of construction were not called into consultation with Mr. Van Emon or Mr. Cobb or the electrical men as to the cause of defects in the operation of the machinery, were you?

A. No, sir.

XQ. 414. And any information that you acquired as to the operation or as to the defects or alleged de-

fects of any of that machinery was based simply upon what you overheard and what you observed at that time. Is that correct?

A. Based upon my experience in trying to run it afterwards.

XQ. 415. In trying to run it after the completion of the tests?

A. After the completion of the tests, and after they were gone.

XQ. 416. How long was the Girard wheel and governor in use after they completed their tests and left?

A. I couldn't tell. Long enough so that we could install another wheel. Possibly five or six months.

XQ. 417. And was this Girard wheel and governor used continuously during that four or five months?

A. Well, all that we could make it do.

XQ. 418. Was your plant in a position to use the work of that wheel during those five or six months, or were other parts of the apparatus also found to be defective during that time?

A. Well, we had one wheel in service, and you understand that this electrical load is a fluctuating load. At one time of the night you have the peak load, and then you have quarter-load, or a third-load. The one wheel had to do all that we did do.

XQ. 419. But during those four or five months, being a new plant, there were defects in the different parts of the machinery, in the parts that were electrical and the parts that were hydraulic?

A. I don't recollect our having electrical troubles, unless it was some trouble with the lines. Our electrical

engineering went from the word go, and very satisfactory.

XQ. 420. After Mr. Cobb and Mr. Van Emon had completed their tests and had left the plant, were your duties changed in any way? Or were you still then occupying the same position as superintendent of the plant?

A. I was superintendent.

XQ. 421. And who was in charge of the machinery at the time?

A. I was.

XQ. 422. And whom were you assisted by at that time?

A. In the electrical department there was a brother-in-law of Mr. Lighthipe left here for thirty days. In the hydraulic, I took care of it myself.

XQ. 423. And in case anything got wrong with the machinery, or anything, did you undertake to repair it yourself?

A. If it could be done here, I did; if it could not, I called a mechanic from town.

XQ. 424. Was it necessary to have a mechanic here from town at times?

A. Oh, yes.

XQ. 425. So that any particular work which required an understanding of mechanics, you called in one who would understand the operation of devices and would be able to make those repairs?

A. When anything occurred there that we did not have the facilities to handle it with here, I got a thoroughly competent machinist from town to do the work.

XQ. 426. Did you have any machinist here, or any-

one who understood the handling of mechanical devices, upon whom you depended during the first five months that you were in charge?

use A. No, sir.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 427. Will you please furnish to Mr. Henry a sample of water which is now supplying the power plant of the Power Development Company, or Power, Transit & Light Company plant, such water to be taken from the pipe-line or penstock of the plant.

Mr. Westall: Objected to as not proper redirect examination, and not proper rebuttal. The kind of water that is here at the present time cannot have any pertinency to the present proceeding. The apparatus which is alleged to have been used here was used in 1898. There may possibly be various reasons why there would be great changes in the water during all that time, and it is not sufficiently shown that there are not such changes.

Mr. Blakeslee: Let the record show that the witness has complied with this request, and a sample of water is now delivered to the Special Examiner in a bottle with a stopper, and the Special Examiner will at all times keep the same in his possession, subject to such tests as may be made of it, during which tests counsel for both parties are to be present. This bottle in its present condition is offered in evidence as "Complainant's Exhibit Bottle of Kern River Water at Power Development Company Plant."

Mr. Westall: Let the record also show that the offer is objected to as irrelevant, immaterial and incompetent,

not proper redirect examination, not proper rebuttal, for the reasons before stated.

(The said bottle of water so offered in evidence is marked "Complainant's Exhibit Bottle of Kern River Water at Power Development Company Plant.")

RDQ. 428. By Mr. Blakeslee: When the plant of the Power Development Company with the Girard apparatus was completed, it was turned over in such completed condition to you for operation under your supervision as superintendent, was it?

A. It was.

RDQ. 429. The Girard governor as used with the Tuthill wheels was only used as a coupling between the wheel shafts and the generator shafts?

A. It was used just the same as it was with the Girard installation—the installation in the wheel case.

RDQ. 430. Did it do anything, however, besides coupling these shafts?

A. When it was governing the Tuthill wheels?

RDQ. 431. Yes.

A. Yes, sir.

RDQ. 432. What did it try to do?

A. Governing the volume of water delivered to the wheel.

RDQ. 433. By means of the control of the deflector-like nozzle?

A. Yes, sir.

RDQ. 434. Was there at any time in your mind a doubt as to what was the trouble with the experimental by-pass device installed with the Girard water-wheel?

Mr. Westall: Objected to as not calling for a statement of facts, but as calling for a psychological condi-

1704 5 Mr. Blakeslee: We object to that as, in view
of the previous question, he did have at times
a mechanic here from the city.

Mr. Westall: That is all.

Page Line

1705 5 add "together with the title of the court and
cause and the date upon which said exhibit
was offered"

1705

tion, if we might use the word, or inquiring into the psychological condition of the witness rather than calling for specific facts. The witness has already testified as to how the matter was coupled up, and as to the facts; and the question is further objected to as not proper redirect examination.

A. No, sir; there was no doubt.

RDQ. 435. By Mr. Blakeslee: Were there any deflecting nozzles on the water-wheels of the Knight type at any time?

A. No, sir.

RDQ. 436. And, therefore, would it or would it not have been advantageous to have a by-pass on the pipeline in connection with the use of these water-wheels?

Mr. Westall: Objected to as purely argumentative, calling for the conclusion of the witness, calling for matters of opinion concerning which the witness has not been shown to be qualified to give an opinion; and, further, as not being proper redirect examination.

A. It would have been.

RDQ. 437. By Mr. Blakeslee: Is that the reason the second sort of by-pass was put on and attempted to be used?

Mr. Westall: Objected to as calling for matters of opinion as to which the witness has not been shown to be qualified to testify.

A. It was.

RDQ. 438. By Mr. Blakeslee: Was there any other by-pass used with the Knight wheels at any time under control of the governor, that is, the Girard governor, than the one which was put in and operated, as you have testified, for about ten minutes?

A. No, sir.

RDQ. 439. Why is it that the operation of this plant, independently of any other plant, at the times that you were with this plant, required careful governing?

Mr. Westall: Objected to on the ground that the witness has not been shown to be qualified to testify as to questions of opinion calling for the training and experience of a hydraulic engineer.

A. To secure good, efficient service for patrons.

RDQ. 440. By Mr. Blakeslee: If careful governing is not provided, in what respects is service so provided inefficient?

Mr. Westall: The same objection.

A. The lighting system is fluctuating and the motor service is interrupted.

RDQ. 441. By Mr. Blakeslee: And how about pipe-line conditions?

Mr. Westall: The same objection.

A. Without good governing it subjects the pipe-line to more or less heavy strain.

RDQ. 442. By Mr. Blakeslee: Do you know any specific particulars in which the conditions at this Power Development Company plant differ from the conditions to be dealt with at other plants where automatic government, or any other kind of governing, is in use?

A. No; I do not.

RDQ. 443. Can you give the names of the companies with whose lines the circuit supplied by this Power Development Company plant is now connected?

A. The San Joaquin Light & Power Company is one corporation.

RDQ. 444. Do you know anything about the governing apparatus that plant has?

A. No, sir.

RDQ. 445. What particular plant of this company is the plant of this company connected up with in that manner, if you know?

A. The steam plant in Bakersfield and the hydro-electric plant in the Crane Valley.

RDQ. 446. When was it that this Power Development Company plant which you are talking about was coupled up with the other plants by a merging of the circuit of this plant with the circuits of the other plants?

A. I cannot answer that.

RDQ. 447. Was it during your connection with this Power Development Company as its superintendent?

A. It was not. We were running absolutely alone.

RDQ. 448. Is the regulation of this plant at the present time on this line, that is, the circuit of this plant, a good regulation?

A. The service is fine.

RDQ. 449. How do you know that?

A. I am enjoying the lights every night, and I see the motors run in town.

RDQ. 450. Do you know what kind of a governor is employed on the Crane Valley plant?

A. No; I do not.

RDQ. 451. Do you know which of the two plants connected up with the line of this plant is doing the regulating, the steam plant or the hydro-electric plant?

A. Only by what I have been told.

RDQ. 452. Did you at any time have anything to do with the ordering or specifying of any of the water

wheels or governing apparatus of either the Girard, Tuthill or Knight types originally furnished to this Power Development Company plant?

A. No; I did not.

RDQ. 453. Am I correct in stating that it is the same Mr. Cobb who assisted in the original installation of the Girard wheel who attempted to install the second by-pass device in the pipe-line for the Knight wheels?

A. Yes, sir; the same Mr. Cobb.

RDQ. 454. And in either of these two devices did the by-pass devices do what Mr. Cobb planned they would do, and do what you as superintendent were given to understand that they were intended to do?

Mr. Westall: Objected to as calling for the guess of the witness as to what Mr. Cobb may have planned, and on the further ground that there is no evidence that this witness was given to understand that they would do anything.

A. No, sir.

RDQ. 455. By Mr. Blakeslee: Before you attempted to operate either of these by-pass devices were you shown a guaranty that the same would operate as therein referred to?

A. I don't recollect seeing it.

RDQ. 456. Were you told that they would operate?

A. Yes, sir. Mr. Beal told me.

RDQ. 457. What did he tell you?

Mr. Westall: Objected to as calling for hearsay.

RDQ. 458. By Mr. Blakeslee: What did he tell you?

A. That they were guaranteed to do the work to effectually safeguard the pipe-line.

RECROSS-EXAMINATION.

By Mr. Westall:

RXQ. 459. Having had nothing to do with the ordering of any apparatus connected with either the Girard wheel or the Tuthill wheel or the Knight wheel, you are not in a position to know the secret motives or reasons that might have prompted the change from one wheel to another, are you?

Mr. Blakeslee: We object to counsel testifying without being sworn. The question is a mere statement of observations on his part, and cannot be testimony in the case, and the question calls for a conclusion and is argumentative.

A. I have no knowledge of what their secret thoughts were. I only know that the device was an absolute failure and they attempted to put something in its place that would do the work.

Mr. Blakeslee: What device are you now referring to?

A. The by-pass on the first installation, on the Girard, the by-pass on the installation of the Knight. No by-pass in connection with the other at all.

San Francisco, Feby. 19, 1915.

CHARLES B. SESSIONS, a witness produced on behalf of complainant, being first duly sworn according to law, testified as follows:

DIRECT EXAMINATION.

By Mr. Blakeslee :

Q. 1. Please state your full name, age, residence and occupation.

A. Charles Benjamin Sessions; age, sixty-three; residence, San Francisco, California; occupation, lawyer.

Q. 2. Have you at any time engaged in other pursuits or business than the practice of law?

A. Yes, sir.

Q. 3. In what industry or line of work?

A. I was manager of the Electrical Engineering Company and the Girard Water Wheel Company.

Q. 4. What years would embrace the period of time when you occupied these positions?

A. The Engineering Company I think from about 1892 to 1896 or 1897, and the Girard Water Wheel Company from probably 1895 to 1896 or seven.

Q. 5. Where were these concerns located?

A. On the west side of Main Street, San Francisco, California, between Market and Mission.

Q. 6. They were California corporations, were they?

A. Yes, sir.

Q. 7. What if any interrelations existed at the time mentioned between these corporations?

A. The Electrical Engineering Company did all of the work in constructing the wheels for the Girard Water Wheel Company.

Q. 8. And the Girard Water Wheel Company took orders for such apparatus, did it?

A. Yes.

Q. 9. Did water-wheel devices constitute the sole or principal business of the Girard Water Wheel Company?

A. Yes, sir.

Q. 10. What was the general business of the Electrical Engineering Company?

A. Making motors and dynamos for power purposes.

Q. 11. Did you know of a certain installation of water wheels furnished to a corporation known as the Power Development Company, and installed by or for it in the Kern River Canyon, some 16 miles east of Bakersfield, Kern County, California?

A. Yes.

Q. 12. Do you know when that installation was made?

A. I have forgotten whether it was 1896 or '97.

Q. 13. One of those years, was it?

A. Yes, sir.

Q. 14. By whom if you know, was the water-wheel apparatus furnished to the Power Development Company, and in what manner?

A. It was furnished by the Girard Water Wheel Company, constructed by the Engineering Company?

Q. 15. The Electrical Engineering Company?

A. Yes, sir.

Q. 16. Who was general manager of those companies at that time?

A. I was.

Q. 17. Under whose direct supervision was this water-wheel apparatus constructed?

A. B. C. Van Emon.

Q. 18. What was his position?

A. He was foreman of the Electrical Engineering Company and the Girard Water Wheel Company.

Q. 19. Did you or your company have any dealings directly with the Power Development Company in connection with this apparatus?

A. Yes.

Q. 20. With whom did you deal as representing those interests?

A. Carroll N. Beal.

Q. 21. What was his office at that time?

A. I don't know in what official capacity he acted. I have forgotten.

Q. 22. Whom did he represent?

A. The Power Development Company.

Q. 23. Where was he or his office located?

A. I don't know whether he had an office in San Francisco at that time or not.

Q. 24. Do you know where he is at the present time?

A. No.

Q. 25. Have you any recollection approximately of the contract or purchase price at which the apparatus was furnished?

A. My recollection is that it was \$5500.

Q. 26. Was that the original estimated cost price?

Mr. Westall: I object to this line of questioning as calling for secondary evidence, no foundation having been laid, and also as incompetent, irrelevant and immaterial and not proper rebuttal.

A. That was the original purchase price.

Q. 27. By Mr. Blakeslee: Was that the final and ultimate cost to the Girard Water Wheel Company and

the Electrical Engineering Company for the manufacture, installation and tuning up of this apparatus?

Mr. Westall: The same objection is repeated. It is now nearly seventeen years since this contract was entered into, and the witness is called upon to give his recollection of the provisions of a written contract without any foundation having been laid. We also object to the evidence as irrelevant, immaterial, incompetent and not proper rebuttal.

Mr. Blakeslee: We are not dealing with the terms of the contract, but actual matters involving cash.

A. It might facilitate matters if you let me explain, without putting it in the record. The foreman estimated that those wheels would cost us \$3300. The original estimate of the cost of the wheels to the Girard Water Wheel Company made by the foreman was about \$3300 and the purchase price or sale price was to be \$5500. As a matter of fact, before we were through with it, they cost us a great deal more than \$5500.

Q. 28. By Mr. Blakeslee: How much more, approximately?

A. They must have cost as much as \$7,000.

Q. 29. What produced this extra cost?

A. Inability to figure correctly.

Q. 30. In what respects did the figuring and calculations go astray?

Mr. Westall: All these questions are objected to as entirely incompetent, irrelevant and immaterial.

A. Figuring the shop time it would take to construct those wheels and the amount of metal that was to go into them, the freight, and the amount of time that

would be required to adjust them down at the plant in Kern County.

Q. 31. By Mr. Blakeslee: Were charges made to your knowledge to the Electrical Engineering Company and the Girard Water Wheel Company, or both, for such adjustment or regulation or experimentation upon this apparatus after it had been shipped to the Power Development Company point of installation?

Mr. Westall: The same objection.

A. Yes, sir; to the best of my recollection.

Mr. Westall: It is pointed out that the cost of this apparatus and any mistakes there might have been made in estimating the price cannot in any way affect the issues in this case.

Q. 32. By Mr. Blakeslee: Do you know of your own knowledge who did any of this experimenting with this apparatus after it was shipped to the Power Development Company's plant site?

A. Van Emon, Berry, and I think Cobb.

Q. 33. And by whom was the cost of such experimental work borne?

Mr. Westall: The same objection.

A. It was borne by the Electrical Engineering Company.

Q. 34. By Mr. Blakeslee: What was the final upshot of such experimental work and the attempted operation of the apparatus at the site of the Power Development Company?

A. We lost.

Q. 35. In what respect?

A. Failure.

Q. 36. What became of the apparatus?

A. I don't know. I think it was thrown out. It was never taken away by us. We never took it away to my knowledge. We never took it away as long as I was connected with the Engineering Company or the Girard Water Wheel Company.

Q. 37. Did you ever visit that plant?

A. No.

Q. 38. Then you don't know of your own personal knowledge what final disposition was made of this apparatus after it was delivered and attempted to be operated?

A. No.

Q. 39. Can you state briefly the chief elements of that apparatus or features of it, without going into details?

A. In what respect? The regulation of it, or what?

Q. 40. What was delivered, grouping the general features of the installation into classifications of work.

A. The Girard water-wheel with the casing, the foundation and the regulating apparatus. .

Q. 41. Do you remember what the regulating apparatus controlled?

A. My recollection is that the regulation apparatus consisted of valves which, when the load was thrown off or the load slackened up, and the wheels would exercise a tendency to speed, that the water would be diverted from the wheels into the waste; and that when the load was thrown on or increased, and there was a tendency for the wheels to slow down, that the water would be re-diverted to the wheels.

Q. 42. So that there was a relief control by a valve under the control of this governor. Is that it?

A. That is my understanding.

Q. 43. Do you know whether this governor had been at any time before used in the attempt to govern any other kind of apparatus?

Mr. Westall: Objected to as not proper rebuttal, incompetent, irrelevant and immaterial, and cannot possibly be in rebuttal of any evidence that has been introduced on behalf of the defendant, and, therefore, irrelevant.

A. Yes; I think the principle involved in this regulator was used in the regulation of what we call constant current electric motors.

Q. 44. By Mr. Blakeslee: Regulation of the brushes of such motors?

A. Yes, sir.

Q. 45. By shifting?

A. Yes, sir.

Q. 46. What was relatively the extent of the work imposed upon the governor in that case as compared with the work imposed upon it in the Power Development Company installation?

Mr. Westall: Objected to for the reasons above stated, and for the further reason that the witness has disclaimed any knowledge of the mechanical details sufficient to give an answer which could be of any weight in this case. He has not been qualified to testify as an expert as to mechanical construction and as to comparative effects that might have been produced by the operation of the principle. It is also suggested that this case involves an apparatus, and not a mechanical principle, and that, therefore, the question is vague and indefinite.

A. The regulation of the electric motor was accom-

plyished by this method: When the load was thrown off or loosened on the motor the brushes moved to a lower point of potential on the commutator, and prevented the motor from speeding up, in proportion to the throwing off of the load; and when the load was thrown on the motor the brushes would move up toward the point of high potential and would have a tendency to cause the motor to speed up or take the load. That was the same principle, I believe, that was used in the Girard water wheel.

Q. 47. By Mr. Blakeslee: In which case was the work the hardest for the governor, if either?

A. Well, I don't know that it was harder in one case than in another. The idea is this: If the load was always the same on the electric motor the brushes remained stationary at a certain point. But if you vary that load by increasing it, the brushes would move up according to the variation of the load to the point of highest potential. But if the load was taken out, the brushes would move down to the point of low potential.

Mr. Westall: Counsel for defendant moves that the answer be stricken out and withheld from consideration for the reason that the witness is called upon to give opinion evidence as to the operation and construction of mechanical devices, without having been shown to be qualified to testify as an expert.

Mr. Blakeslee: The ground of the motion appears to be foolish. The witness has been asked questions of fact and not of opinion.

Q. 48. Did the governor in this case do anything more than merely shift the brushes or brush carriages?

A. That is all.

Q. 49. Was there any relief valve or device, or any-

thing of that sort, installed in connection with the brushes?

A. No.

Q. 50. And how did the action of this Girard governor in connection with the brushes compare with the action in connection with the other parts of the Girard apparatus furnished to the Power Development Company?

Mr. Westall: Objected to for the reasons before noted on the record, and the objection that this evidence is entirely incompetent, irrelevant and immaterial, is repeated and is to be understood as applying to all this line of questioning.

A. In the case of the water wheel, instead of shifting the brushes it shifted the water.

Q. 51. By Mr. Blakeslee: And how successfully did it shift the water?

A. I don't think it did it successfully.

Q. 52. Was it anything more, as a matter of fact, than an absolute failure in that connection?

A. Of course, I have no personal knowledge of that, but my information was at the time from the reports made to me that it was a practical failure.

Q. 53. And those reports came to you from your men, such as Mr. Van Emon, Mr. Berry and also Mr. Cobb?

A. Yes, sir. .

Q. 54. They were the engineers in connection with the work you have previously mentioned?

A. Yes, sir.

Q. 55. You took no steps, did you, that is, your company or companies, to use or take away or further

utilize this Power Development Company apparatus furnished by you and your companies after it was thrown out down at the plant of the Power Development Company?

A. To the best of my knowledge, no.

Q. 56. Why didn't you?

A. Well, the place where the plant was erected was remote. Wagon and railroad freight was expensive. I suppose those were the reasons.

Q. 57. Had it been of any appreciable value it could have been applied in such value as against the loss of some \$4,000 which your companies had made on this contract, could it not?

A. Yes; I suppose so. There was a large amount of metal there that was of considerable value.

Q. 58. Did you continue, that is, your company,—did they continue to manufacture that type of water-wheel apparatus and regulating apparatus after that time?

A. No.

Q. 59. Why not?

A. The company went out of business. The company was practically insolvent.

Q. 60. Due in any part to this failure of this apparatus and the loss on the contract?

A. That was largely a contributing cause.

Q. 61. Do you know whether Mr. Berry or anyone else ever applied for any Letters Patent on this apparatus furnished to the Power Development Company?

Mr. Westall: Objected to on the ground that it is not proper rebuttal testimony, incompetent, irrelevant and immaterial.

A. No; I do not.

Q. 62. By Mr. Blakeslee: Did you ever hear that he did?

Mr. Westall: The same objection.

A. I never heard.

Q. 63. By Mr. Blakeslee: During the construction of this Power Development Company contract apparatus did you or did you not keep in touch with its manufacture?

A. Yes, sir.

Q. 64. Did you visit the shop where it was being made?

A. Yes, sir.

Q. 65. And familiarize yourself generally with its development?

A. Yes, sir.

Q. 66. I show you a number of cuts and blueprints and ask you whether they suggest anything to you in connection with any of the apparatus which you know or have had knowledge of?

A. Yes, sir. These blueprints which you show me, to the best of my recollection are blueprints and drawings made for the Girard water wheel or water wheels that were installed in Kern County.

Q. 67. In other words, in a general way they depict the apparatus you have told us about, furnished to the Power Development Company?

A. Yes, sir; in a general way.

Mr. Blakeslee: Let it be shown on the record that the witness has referred to "Defendant's Exhibit Cobb Blueprint No. 1," and "Defendant's Exhibit Berry Blueprint No. 1."

Q. 68. Had you thought it possible to utilize this Power Development Company apparatus after it was thrown out, on any other water-wheel apparatus contract, would you not have made arrangements to salvage the same?

A. I was not in a position at the time to do that, for the reason that my relations with the Electrical Engineering Company were severed and the Electrical Engineering Company brought suit and attached all of the property belonging to the Girard Water Wheel Company. When I say "all of the property", I mean all of the property here. I don't think they attached anything down there.

Q. 69. Do you remember whether or not in connection with the winding up of the affairs of the Girard Water Wheel Company any of the blueprints or drawings or other shop records of this Power Development Company apparatus or type of apparatus was turned over to Mr. Berry, the engineer you have told us about?

Mr. Westall: Objected to as leading and suggestive.

A. Berry brought suit for his salary and attached all the drawings and blueprints.

Q. 70. By Mr. Blakeslee: And what finally became of them?

A. They were sold and he bought them.

Mr. Blakeslee: That is all.

CROSS-EXAMINATION.

By Mr. Westall:

XQ. 71. You have never had any special mechanical, hydraulic or electrical training or education which

would fit you to describe with any degree of precision a mechanical or electrical device which you may have seen?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent and not cross-examination, and uselessly incumbering the record. The witness has testified purely with relation to his experience, knowledge and facts and not as an expert.

A. No.

XQ. 72. By Mr. Westall: Then any knowledge that you acquired and about which you have testified as to the use and operation of the devices which you have pointed out as having been illustrated in "Defendant's Exhibit Cobb Blueprint No. 1," and "Defendant's Exhibit Berry Blueprint No. 1," was merely a superficial knowledge acquired largely by hearsay and not acquired by any careful analysis or examination of any of the devices installed. Is that correct?

Mr. Blakeslee: Objected to as merely argumentative, calling for a conclusion, not the proper method of proof, not cross-examination, irrelevant, immaterial and incompetent.

A. I will say this: I have no mechanical experience at all and could not pass upon any mechanical device. The knowledge I gained of those things was through an observation of the things in the shop that we constructed and conversations with the foreman. I had a pretty fair theoretical knowledge of electrical matters, but no mechanical knowledge.

XQ. 73. By Mr. Westall: You have testified that the apparatus installed by the Girard Water Wheel Company was a failure, and that it was taken out and

discarded. But you would not attempt to specifically point out the mechanical reasons for that failure, nor would you attempt to describe the parts of the devices which were found to be inefficient?

Mr. Blakeslee: The same objection.

A. No.

XQ. 74. By Mr. Westall: Have you been on friendly terms with Mr. Cobb since that time?

A. Oh, yes.

XQ. 75. Are you still on friendly relations with him?

A. Yes. I have not seen him for many years.

XQ. 76. And with Mr. Berry?

A. Yes.

XQ. 77. Have you seen Mr. Berry recently?

A. No; it has been a year or two.

XQ. 78. And with Mr. Van Emon?

A. No. Our relations have not been friendly.

XQ. 79. If Mr. Cobb and Mr. Van Emon and Mr. Berry, being those who were in charge of the mechanical work, were all to testify unanimously that the reasons for taking out this apparatus was because of inefficiency of the water wheel, would you be inclined to believe that they knew what they were talking about?

Mr. Blakeslee: Objected to as merely hypothetical, not the proper method of proof and not cross-examination.

A. Yes.

XQ. 80. By Mr. Westall: And you would not attempt to dispute any of their conclusions as to the exact mechanical causes of the failure?

Mr. Blakeslee: The same objection.

A. No.

XQ. 81. By Mr. Westall: Do you believe that Mr. Cobb is competent after his examination and experience at the plant and after the failure to give the reasons for that failure?

~~A. I have finished.~~

A. Yes; I think he is competent.

Mr. Blakeslee: The same objection.

XQ. 82. By Mr. Westall: Now, the reason that any of the devices which were discarded by the Power Development Company was not taken back and utilized by the Girard Water Wheel Company was on account of the great expense of moving such devices from such a destination, was it not?

A. Yes, I think so.

XQ. 83. And the cost of transportation as well as the labor of taking out those devices would probably have been of great weight as a determining factor as to whether or not they should be attempted to be saved?

A. Yes.

Mr. Westall: I believe that is all.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 84. How much do you suppose it did cost to transport this apparatus to the Power Development Company plant and put it inside of the house?

Mr. Westall: Objected to as calling for a mere supposition.

A. I think before we were through with it it cost over \$7,000.

RDQ. 85. By Mr. Blakeslee: I mean the actual cost of transportation and putting it on its foundation down there.

A. I think the railroad freight was something like \$450, and the wagon freight was I don't know what, and installing it I don't know what that was. It required a number of men for a long time.

RDQ. 86. Did it cost over a thousand dollars to put it on its base?

A. It must have.

RDQ. 87. How much more?

A. I don't know.

RDQ. 88. Did it cost half of the entire cost price?

A. I really could not say. You know there was a suit brought against the bondsmen of the Girard Water Wheel Company on account of the inefficiency of those wheel.

RDQ. 89. And you or your companies figured that if those wheels were brought here it would be bringing back just so much junk. Is that correct?

A. I believe that was the impression at that time.

RDQ. 90. Now, in your last answer in which you referred to inefficiency of the wheels, did you refer to the wheels per se, or the entire apparatus as furnished on the order?

Mr. Westall: Objected to as being a very specific statement by the witness. He has stated that it was the inefficiency of the wheel.

Mr. Blakeslee: He can adhere to his statement if he wants to. That is why I asked the question.

Mr. Westall: And he has also said that he is incompetent to pass upon the precise reasons.

A. I must explain to you the point on which the suit went off. The plaintiffs in that case tried to establish that the wheels did not come up to the guaranteed efficiency of the contract and it developed in the case that so much power was to be delivered to the wheel, and they had no method of measuring the loss of the water after it left the standpipe to the smaller pipes delivering it to the wheels. It could not be determined just exactly how much power was delivered to the buckets of the wheels. They could measure the amount of water or the amount of power at the standpipe, but they had no method of measuring beyond that, and for that reason the plaintiffs lost their case.

RDQ. 91. By Mr. Blakeslee: In other words, the plaintiff failed to sustain its contention in this suit that the wheels were not of the guaranteed efficiency, and that was the finding of the court. Is that correct?

A. I think that is right.

Mr. Blakeslee: That is all.

CARROLL N. BEAL, a witness produced on behalf of complainant, being first duly sworn according to law. to testify the truth, the whole truth and nothing but the truth, testified in rebuttal as follows:

DIRECT EXAMINATION.

By Mr. Blakeslee:

Q. 1. Please state your full name, age, residence and occupation.

A. Carroll N. Beal; residence, San Francisco, California; age, sixty-four; occupation, attorney-at-law.

Q. 2. Have you always followed the occupation of

attorney-at-law solely, or have you been interested in other matters?

A. Well, not for the record, I am not occupying myself much as an attorney-at-law just now.

Q. 3. Have you at other times given attention to any other line?

A. I have had considerable training in mechanical engineering and general civil engineering work.

Q. 4. Have you taken academic study?

A. None.

Q. 5. What was the cause of your study?

A. Primarily, the necessity for finding things out.

Q. 6. When did that commence?

A. Several years ago.

Q. 7. Did you utilize your studies?

A. Yes, sir; I did considerable engineering construction work.

Q. 8. In what general line?

A. Electric, hydraulic and railroad.

Q. 9. Can you mention the names of any interest or company with which you were connected for the last thirty years in which you utilized such information?

A. In which particular line?

Q. 10. Hydraulic and electric.

A. The hydraulic and electric work of the Power Development Company, Bakersfield, and hydraulic work for the Bay Cities Company and the Sierra Water Supply Company of San Francisco.

Q. 11. Were the last two instances before or after the Power Development Company?

A. Subsequent to it.

Q. 12. When did the Power Development Company experience commence?

A. My recollection is that that was in 1895 or six.

Q. 13. What was your connection with these matters?

A. I was chief engineer of the Power Development Company and general manager of its business.

Q. 14. Where were you located?

A. My headquarters were in San Francisco; my activities were largely in Bakersfield.

Q. 15. Where was the property or plant of the company located?

A. On the Kern River about 15 miles northeast of Bakersfield.

Q. 16. Do you remember when the installation was put in?

A. No, I do not, without reference to dates. I think the plant was started up along in 1897. I am not a great chronologist.

Q. 17. You were never connected with any other concern or plant of those names?

A. No; not of those names. I have been connected with a dozen different electric plants at one time or another.

Q. 18. Do you know who erected the buildings for that plant and had actual charge of the work?

A. James F. Dearth was superintendent.

Q. 19. Where does he reside?

A. Bakersfield, I think.

Q. 20. Did he ever do anything else in connection with the property of that company?

A. He was the general superintendent, and had man-

agement and oversight of all of the mechanical activities on the Kern River Canyon where the plant was located.

Q. 21. How long did he hold that position?

A. He began with the inception of the plant and held it till about four years ago.

Q. 22. From whom did he take orders or to whom was he responsible in the Power Development Company for his work as superintendent?

A. To me, primarily.

Q. 23. Did he have anything to do with the original purchase and specification of hydraulic and electrical apparatus installed from time to time at that plant?

A. I think not, except in an advisory way.

Q. 24. Who did have that power?

A. I did.

Q. 25. What sort of services did Mr. Dearth render as superintendent of that company at its plant?

A. He was there looking out for the company's interest in every way, carrying forward the work. The company was doing with its own force the work and he was constantly in touch with the work being done under the contract.

Q. 26. What was the nature of his services with reference to efficiency?

A. First class.

Q. 27. Did you have any complaints to make to him or of him for his services as superintendent?

A. No, sir; none whatever.

Q. 28. And during the time he was superintendent, did or did not the Power Development Company earn a profit in the operation of that plant?

A. Yes. The Power Development Company was profitable, but Mr. Dearth had absolutely nothing to do with that, other than he might have made that profit less by inefficient handling.

Q. 29. Did he make it less in any such way?

A. I have no recollection of anything of that kind.

Q. 30. Aside from the question of capability and performance of duty, have you anything to say with respect to the general reliability, veracity and moral character of Mr. Dearth?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial. There has been no attack made upon the veracity of Mr. Dearth.

A. Mr. Deart his a high class man in every respect; morally, mentally and mechanically.

Q. 31. By Mr. Blakeslee: Did he or did he not during the period of his experience with this plant and his superintendence of it, display to you any material knowledge with respect to electrical matters concerned in the superintendence of that plant?

A. Mr. Dearth went to the plant with only the general superficial knowledge of electricity that a mechanical man would have. His electrical education he got at that plant; practically all of it.

Q. 32. And did you note from time to time an increase of his fund of information in electrical matters during his connection with that plant?

A. Naturally, yes. He was very much interested in the electrical end of it, and he was of an investigating turn of mind and informed himself to the best of his ability by observation, consultation and so forth.

Q. 33. And his pay was increased, or was it not?

A. I have no recollection how he was paid from time to time.

Mr. Westall: This line of questions is objected to as irrelevant, immaterial and incompetent.

Q. 34. By Mr. Blakeslee: Can you give me the name of anyone else who was connected with Mr. Dearth in the handling of that plant?

A. There was quite a number of men working under orders. He had no assistant superintendent.

Q. 35. Can you give me the names of any of these during the earlier period of operation or attempted operation of the plant?

A. Mr. E. M. Beal was with him during all of the time of construction and for quite a period during the subsequent operation of the plant. I would have to pound my memory a good deal to recall the names of the men about that plant at that time. Mr. Dearth was the man in charge of that plant. My son paid special attention to the electrical end of it, and was infinitely more skillful in that branch than Mr. Dearth ever was.

Q. 36. When did you sever your connection with the Power Development Company?

A. The Power Development Company was subsequently merged in the Power, Transit & Light Company, and continued under that for a number of years; and that company was sold out about six years ago, I think.

Q. 37. To what interests?

A. The San Joaquin Light & Power Company, if that is the name. The Balch-Kerckhoff interests in Los Angeles. I want the reporter to note that I have a strong reservation on dates, I do not pretend to be accurate on dates. I don't want to commit perjury.

Q. 38. Do you know whether that Power Development Company plant is now operated in connection with any other plant in the San Joaquin Valley?

A. Only by rumor.

Q. 39. You were, I understand, then, the manager of this Power Development Company from its inception until its dissolution or merger with the Power, Transit & Light Company?

A. That is true. It was disincorporated and went out of business. The Power Development Company did sell its properties.

Q. 40. Did Mr. Dearth have anything to do with the management or supervision of the affairs of the Power Development Company by direct consultation with the officers and directors of that company?

A. Nobody but myself. The responsibility was entirely to me.

Q. 41. His responsibility was entirely to you?

A. Yes.

Mr. Blakeslee: That is all.

CROSS EXAMINATION

By Mr. Westall:

XQ. 42. When Mr. Dearth was first employed by the company he was a carpenter, was he not?

A. Carpenter and millwright, and operation and working of large machinery.

XQ. 43. He was a sort of a general handy man?

A. He was a high class man and, in my mind, there is a very material distinction between that and a handy man.

XQ. 44. But his principal duties were as superintendent of erection of the buildings?

Mr. Blakeslee: Objected to as indefinite, no time mentioned, and calling for a conclusion.

XQ. 45. By Mr. Westall: I am speaking of when he was first employed by the company, before the installation of the machinery.

A. Before the installation of the machinery Mr. Dearth built across the river which you crossed yesterday or day before a bridge. He built a flume which was superceded by a tunnel. He built the residence building. I mean that was the character of his activities leading up to the installation of the machinery.

XQ. 46. When you speak of a high class mechanic you do not mean as a man of technical education?

A. Oh, no. There is quite as much difference between that and a mechanical engineer as there is between a mechanic and a handy man.

XQ. 47. So, by the use of the term "high grade mechanic," you mean that he was skillful in the use of tools?

A. Skillful and experienced and a man of sound mechanical ideas.

XQ. 48. Were you acquainted with Mr. Cobb?

A. Very well.

XQ. 49. And with Mr. Berry?

A. I knew Mr. Berry, yes.

XQ. 50. And Mr. Van Emon?

A. Yes, sir.

XQ. 51. Have you been on good terms with those gentlemen?

A. Absolutely nothing ever occurred to mar my relations with any of them.

XQ. 52. And would you be inclined to accept the statements of Mr. Cobb and Mr. Van Emon and Mr. Berry as to the causes of failure of any part of the apparatus in the plant at Bakersfield?

A. As far as the integrity of the statement, I would accept it without question.

XQ. 53. And you believe that the gentlemen I have mentioned, after their experience at the plant and their connection with the plant, are competent to give an intelligent reason for any defects that might have come to light in the operations?

A. If their reasons coincided with mine, I would agree that it was intelligent. I don't know. I have had a good many fights with all those men on mechanical problems, and I thought I had better ideas than they had, and I seem to have had, as demonstrated by experience at that plant, because I condemned a number of mechanical things incorporated in that plant with the sanction of Mr. Cobb, as a special consulting mechanical engineer, in my interest and the interest of the company, and controversies that I had where he and Mr. Berry and Mr. Van Emon wanted to do certain things, which, according to my construction, the Girard Water Wheel Company were entitled to under their contract, they having guaranteed results only and not the special means for attaining the results, and where I disagreed with them, and their ideas were carried out and failed. So I make a reservation in that. And yet I think they are high class men, all of them; but some of them are sometimes mistaken. I can prove that by Mr. Henry. He is a high class man.

XQ. 54. Did you have supervision over Mr. Cobb and Mr. Berry?

A. Mr. Cobb reported to me; Mr. Berry did not.

XQ. 55. And any differences of opinion between yourself and Mr. Cobb would be finally decided by you?

A. Yes, in a matter that I had absolute control of. But in a matter of contract where results were guaranteed, the final decision rested with the contractor. Mr. Berry was allied to the contractor, as also was Mr. Van Emon. Cobb was my employee.

XQ. 56. Did you have anything to do with the approval of the contracts or the proposals for contracts which were offered by the various companies for the installation?

A. I think I had everything to do with it.

XQ. 57. And you approved the contract with the Girard Water Wheel Company for the installation of its apparatus?

A. I certainly did.

Mr. Westall: That is all.

REDIRECT EXAMINATION

By Mr. Blakeslee:

RDQ. 58. I take it you approved this contract before it was executed or attempted to be filled?

A. The solicitation for tenders was made on the basis of accomplishment. The means for accomplishment were left to the bidder.

RDQ. 59. But you approved of the contract?

A. When it was finally put into form. It was first approved by our counsel, and then it was approved by

us after we looked upon it to find out whether we would have a right to expect it to be fulfilled.

RDQ. 60. The apparatus which the Girard Water Wheel Company furnished to the Power Development Company under that contract was subsequently discarded, was it not?

A. Yes, sir; practically all of it. I think parts of it were built into the subsequent installation.

RDQ. 61. Do you know what was done with the parts that were discarded?

A. I haven't any idea. I think they were broken up and sold for scrap iron.

RDQ. 62. And Tuthill and Knight wheels were put in?

A. Tuthill wheels were put in after the Girard wheels were turned down, and subsequently Knight wheels were put in.

RDQ. 63. Do you know whether Mr. Dearth designed the flume you said he put in at that Power Development Company, and the bridge he erected over the creek?

A. No; he did not. My consulting civil engineer was responsible for those designs.

RDQ. 64. And of the bridge too?

A. Yes, sir.

RDQ. 65. How did you find Mr. Dearth's opinions generally as to matters coming within the field of his superintendence of the plant?

A. In what respect?

RDQ. 66. As to their reliability or value.

A. His opinions were always good. They were not technical opinions, and not such an opinion as I would

expect to get from a man whom I was consulting as a specialist.

RECROSS EXAMINATION

By Mr. Westall:

RXQ. 67. The reason the Girard wheel was taken out was because it did not develop the required horse-power? Is that not true?

A. That is one of the reasons; yes.

RXQ. 68. And there was some error in calculation, was there not, as to the amount of horse-power, or the kind of a wheel that would develop that horse-power?

A. I hardly know how to answer that—

Mr. Blakeslee: Objected to as indefinite.

A. We took several means from time to time—and which installation it was applied to I cannot tell—to determine the amount of power that was being developed, and also the amount of water that was being used to develop that amount of power. There was more or less conflict in those things, and some variation in the calculations. I think what you refer to is controversies between Mr. Cobb and myself in regard to the load as measured by the dynamometer at one time. I disagreed with Mr. Cobb very radically upon his process that he followed to determine the results of the forces. We were a long, long, long way apart. And finally I submitted it to a consulting engineer in New York.

Mr. Westall: I believe that is all.

REDIRECT EXAMINATION

By Mr. Blakeslee:

RDQ. 69. After the Girard wheels or apparatus

were discarded at the Power Development Company plant and the Tuthill wheels had also been discarded, is it, or is it not true, that a system of hand control was installed at this plant for regulating the water wheels?

A. Yes, sir; but the automatic control was not at the same time abandoned. It was also left in place.

RDQ. 70. But the hand control superseded it in the regulation of the plant?

A. I think we used the hand control largely. Mr. Dearth's recollection of that would be infinitely better than mine as to when one succeeded the other.

RDQ. 71. And you don't know whether all the automatic control features or part of them were retained?

A. No, sir.

RE CROSS EXAMINATION

By Mr. Westall:

RXQ. 72. When the Girard wheel was taken out and a wheel called the Tuthill wheel was put in?

A. Yes, sir.

RXQ. 73. And the Tuthill wheel having a different method of regulating the speed could not utilize in full the means that had been adopted for use of the Girard wheel previously?

A. That raises the question of chronology in my mind. I don't know.

RXQ. 74. I am assuming that the Tuthill wheel followed the Girard wheel.

A. There is no question of that in my mind at all. That was the order of installation. Girard, Tuthill, Knight. That was the order of installation. That I am very confident of. When the Tuthill wheel was put in

I do not have in my mind a definite recollection of the regulation means that were applied to it. We never attempted to work that problem out with the Tuthill wheel to its finality for the reason that the wheel did not give the power.

RXQ. 75. And the main reason for discarding the Girard wheel was that it would not give the power?

Mr. Blakeslee: Objected to as calling for a conclusion and not the proper method of proof, and calling for an opinion of the witness.

that A. The Girard wheel would not give the power; that was the main reason. And in the low outputs regulated. In the higher outputs of its capacity it did not regulate. I want to say this, as I recall the thing, and that is, owing to the inability of both the Girard wheel and the Tuthill wheel to give the necessary required output, the governing system of those was not tried out as thoroughly as it otherwise would have been.

RXQ. 76. By Mr. Westall: That is the Girard and Tuthill?

A. Both. The fine governing features were not tried out as they would have been tried out had the power output been there.

RXQ. 77. So that the failures of the wheels to give the required efficiency was the main and primary cause of their being discarded?

Mr. Blakeslee: Objected to as calling for a conclusion and not a proper method of proof.

A. If you don't get the power it don't make any difference how well they are regulated. Power was the primary sine qua non. Regulation was to follow.

Mr. Westall: I believe that is all.

REDIRECT EXAMINATION

By Mr. Blakeslee:

RDQ. 78. You got sufficient power and efficiency by the use of the final Knight wheels, did you not?

A. We did not get what we started out to get, but we got what we thought was best under the conditions.

RDQ. 79. Those wheels were not superseded by any others in the plant?

A. Not during my connection.

RDQ. 80. Do you know whether an attempt was made to use any governing apparatus in connection with the regulation of the Knight wheels?

A. Yes, sir. I designed that governor myself.

RDQ. 81. And what was the result of its attempted use?

A. It was fair; not high class, but fair.

RDQ. 82. What did the governor do?

A. It deflected the water.

RDQ. 83. Was there a by-pass device installed in connection with it and attempted to be operated for relieving the penstock?

A. I think not. I am not certain on that point.

RDQ. 84. Prior to the installation of your deflector device do you know whether or not the Knight people put in a nozzle-block construction that was attempted to be operated by a governor conjointly with the by-pass?

A. The governing installation installed by the Knight people consisted of a butterfly valve operated by a worm gear, and I am not able to say whether any of the water was deflected from the supply-pipe by that or not. My recollection is that it was not.

RDQ. 85. Have you any recollection of Mr. Cobb attempting to operate a by-pass in connection with the Knight wheels?

A. I am too hazy to answer that.

RDQ. 86. Now, these butterfly valves that you speak of in connection with the use of the Knight wheels, were in the pipe-line or supply-pipes controlling the flow of the water to the wheels?

A. Leading up to the nozzle block.

RDQ. 87. Those were worked by hand, were they not?

A. Yes, sir; there was but one in each supply-pipe, and it was worked by hand through a worm-gear device.

RDQ. 88. And that was prior to your building the deflecting device?

A. The deflecting device was after the knight wheel was accepted. The contract with Knight did not call for anything but the hand government which he installed, and subsequently we put in the deflector plates.

RDQ. 89. And before you put in the deflecting device there were slide valves on the nozzle blocks? That is, with the Knight wheels?

A. I don't think so.

RDQ. 90. You don't remember what was there?

A. I don't think there was anything there except the ports.

RDQ. 91. But subsequently and after the attempted use of your deflectors hand control was resorted to?

A. The deflectors were installed and operated with the wheel, and then a system of control of the wheels was put in by Mr. A. M. Hunt, by which it could be operated from the switch-board.

RDQ. 92. By means of a butterfly valve?

A. I won't say about that. There was a cut-off or cylinder valve in that supply-pipe. I don't know whether they used the butterfly valve or that cylinder.

RDQ. 93. However, it was purely a hand control?

A. The governing device ~~which~~^{that} I put there was for trial and was not regarded as adequate without hand control, and the Knight hand control was superseded by Hunt's installation.

RDQ. 94. And that was hand controlled through the feed pipes?

A. Yes; but whether it operated through a butterfly valve or through this hydraulic cylinder, I don't know.

RECROSS EXAMINATION

By Mr. Westall:

RXQ. 95. When did you sever your connection with this company?

A. About six years ago.

RXQ. 96. Up to the time you severed your connection they had had no form of purely automatic government?

A. None that was successful.

RXQ. 97. There were many successful governing devices on the market prior to the time you severed your connection with the company, were there not?

A. So claimed by the manufacturers.

RXQ. 98. But you did not believe that any of those governors would be—

A. (Interrupting) I do not see that any of the conventional or standard makes were applicable to our conditions.

RXQ. 99. Did you believe that you had a specially hard set of conditions to meet with which would more than tax the capacity of the forms of governors that were then on the market?

A. No; it was not our natural conditions. It was the condition resultant upon putting in one installation and then remodeling it for the second one, and then again for the third one, that created a installation the like of which was never contemplated by anybody originally who would be designing a governor for the purpose of meeting the requirement of a standard installation. We did not have a standard installation.

RXQ. 100. And it was that anomalous condition that kept you from installing a more modern form of governor?

A. I don't know whether I ought to answer yes or no to that. There was not any more modern form of governor than the one I put in. It was the first and only one of its kind. It was the most modern thing there was at that moment. There were a number of governors manufactured by various manufacturing concerns like the Lombard, for instance, but on inspection of those I did not see that they could be economically applied to our conditions. Hence the special designs.

RXQ. 101. You were paying something like \$180 or \$200 a month for extra help to take care of the manually-operated governor, were you not, which you would have saved if you had put in one of these automatic governors?

A. We were paying a certain charge per month for hand work that, if it had been done automatically, would

have been saved, less the fixed charge against the automatic machinery.

RXQ. 102. And did you believe it would be more economical to pay that extra money, that is, up to the time that you severed your connection with the company, than to install ~~all~~ the modern improvements in governing apparatus that had been made at that time?

A. I doubted the wisdom of making such an installation, because I doubted the applicability of any of those modern governing mechanisms that you refer to, to our conditions.

RXQ. 103. Could you briefly describe what those peculiar conditions were which made you doubt the availability of those governors?

A. I don't think I could give any intelligent idea. We started in with the Girard Water Wheel Company. The Girard water wheel failed to meet the requirements, and those conditions laid out by its engineers fitted exactly to its designs were then availed of in the highest possible degree in the succeeding installation—in the Tuthill installation and the same thing with the Knight wheels. Our installation was far from standard, and so far as I could discover, there was no governing device on the market that would go in without abnormal cost.

RXQ. 104. That is, in the way of re-assembling or re-arranging the machinery?

A. Call it rebuilding it, if you please. In other words, if you put in a governor of standard type at that time, it was substantially made for an entire new water-wheel installation.

RXQ. 105. And your opinion was that the cost of putting in that new installation would far exceed the cost

of paying the extra amount to these employees who operated the hand control?

A. My judgment was that it was not an economical thing to do.

Mr. Westall: I believe that is all.

REDIRECT EXAMINATION

By Mr. Blakeslee:

RDQ. 106. In other words, I take it that you purchased in the beginning of this Power Development Company plant, an installation that was built for the use of a certain governor in connection with certain features of control of the supply of water to the wheel, and certain features providing for relief of pressures in the pipe-line by the attempted use of a by-pass, and that the plant so originally organized, when you found these features were not operative and were thrown out, could not be adapted to the use of another governor without entirely reorganizing the installation with the object in view of putting in such other governor. Is that a fair statement?

Mr. Westall: Objected to for the reason that it does not correctly state anything the witness has testified to. The witness has not testified that the particular features that have been mentioned were not operative.

Mr. Blakeslee: Let the witness state whether that is a fair summary of his testimony.

A. Let me give you a brief resume as it occurs to me. We specified conditions and requirements with respect to the power output and the governor. The Girard Water Wheel Company accepted the responsibility of complying with those requirements, the design being left entirely to them except it was to occupy a given space. In all

other respects the design was entirely their own. We had nothing to do with it. The only thing that we had to say with regard to the Girard Water Wheel Company was that it must not encroach upon certain spaces allotted to our machinery, and that its mechanical sufficiency must meet with our approval. Its efficiency and power output was fixed by the contract. Pursuing this contract, the Girard Company put in a certain installation which failed for reasons previously stated. What was then there on the ground was taken and availed of as was thought possible to accomplish the installation of the Tuthill wheels which again failed, the same requirements having to be met. And then what was available of the two former installations was availed of to whatever degree was found possible in the Knight installation.

RDQ. 107. In other words, you proceeded by a sort of a metamorphosis, from Girard to Tuthill and from Tuthill to Knight, working over what you had as best you could. And had you attempted to install another form of automatic governor or an operative form of governor, it would have been necessary to entirely reorganize the installation to provide for such governor. Is that correct?

A. It would have been necessary to modify it very materially in order to make it adaptable to the operation of what was regarded as the standard type of governors.

RDQ. 108. Then could you have known, and for all practical considerations, the failure of the attempted automatic governor originally installed by the Girard people meant failure of that plant in so far as governing was concerned? Is that correct?

Mr. Westall: Objected to as erroneously quoting the

testimony of the witness and assuming facts that have not been shown.

A. My recollection of the Girard governor is that within certain compasses it operated fairly well.

RDQ. 109. By Mr. Blakeslee: But when that apparatus was discarded it marked the finality with respect to attempts to automatically govern that plant?

A. No; that is not true. Because after the Knight wheel was put in the deflecting plates put in it were still actuated by the dynamometric part of the original Girard installation.

RDQ. 110. But there was no successful operation of any by-passing device?

A. As I have stated, my recollection of the chronology of the by-pass devices is not accurate enough to be of value to either of you.

RDQ. 111. But what ultimately occurred was that hand control was resorted to in that plant?

A. In my connection with it, up to the time that I ceased to have any active connection, the automatic governing device in the Knight wheel was still in position.

RDQ. 112. But was not automatically governed?

A. The automatic governing of the plant was supplemented by a hand device, or either of them could be thrown out of commission and the other relied on alone. But we did not feel safe in relying on the automatic governor.

RDQ. 113. And there was no by-pass device in that governing at that time?

A. I will not make any statement about that. Mr. Dearth's chronology ought to be accurate.

RDQ. 114. At the time you severed your connection

with the company there was no such by-pass in operation?

A. I think not. I think it was finally abandoned.

RDQ. 115. You did not design any by-pass device for the Knight wheel installation, did you?

A. No.

RDQ. 116. Then, as I understand it, this overhead charge of approximately \$200 a month for extra assistance utilized in operating the hand control at the Power Development Company's plant was made necessary or caused by the fact that there never had been in this plant an automatic governor which had qualified to continuously control that plant?

A. There never was an automatic governor in the plant that justified the abandonment of the means for hand control.

RDQ. 117. And in the metamorphosis of this plant from Girard to Tuthill and from Tuthill to Knight you discarded what you felt could not be availed of or incorporated in future installations. Is that correct?

A. Yes; our arrangements with the contractors subsequent to the Girard wheel, were, "there is the plant; avail yourself of what you can, and put in a plant with the guaranty."

RDQ. 118. What was done with the parts of the plant thrown out?

A. Scrapped.

Mr. Blakeslee: That is all.

Feby. 19, 1915, P. M.

RUDOLPH W. VAN NORDEN, a witness produced on behalf of complainant, being first duly sworn accord-

ing to law to testify the truth, the whole truth and nothing but the truth, testified in rebuttal as follows:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 1. Please state your full name, age, residence and occupation.

A. Rudolph W. Van Norden; occupation, consulting engineer; age, thirty-nine years; residence, San Francisco, California, and place of business, San Francisco, California.

Q. 2. In what lines have you engaged as consulting engineer?

A. Principally in hydro-electric work and hydro-electric installations and designs.

Q. 3. What training, briefly stated, have you had in preparation for such consulting engineering?

A. I am a graduate of Stanford University and my experience covers about twenty years in this work.

Q. 4. Graduating in electrical engineering?

A. Mechanical engineering.

Q. 5. And you studied electrical engineering in addition?

A. Yes, sir. I might say I am a fellow of the American Institute of Electrical Engineers, first grade, and a member of the American Society of Civil Engineers.

Q. 6. Do you know of a light and power corporation in the state of California having the name of the San Joaquin Light & Power Company?

A. Light & Power Corporation; yes, sir. I am quite familiar with it.

Q. 7. Have you visited any of their stations?

A. All of them, with the exception of an abandoned station on the Merced River.

Q. 8. In what connection did you happen to visit them?

A. I visited their stations in order to write up a technical description of their entire system.

Q. 9. For publication?

A. It was for publication, ostensibly, but in realty for distribution among their bond holders, so they could sell bonds.

Q. 10. When did you visit the stations of the San Joaquin Company?

A. I don't remember just the date, but it was about somewhere between the 20th of March and the 5th or 6th of April, 1912.

Q. 11. Will you please mention the names of a few of the stations of this company which you visited at that time?

A. There are three hydraulic stations: San Joaquin No. 1, San Joaquin No. 2, and the Power Development station on the Kern River. I have forgotten the original name of the company, but at that time it was the property of the San Joaquin Light & Power Corporation, so it is a San Joaquin station. Incidentally, I visited the Edison station of the Edison Light & Power Company on the Kern River, and a year later, in December, 1913, I visited the new Tule station of the San Joaquin Light & Power Corporation on the Tule River. That was a year and a half ago.

Q. 12. And what water supplies this Tule station?

A. The north fork of the Tule River.

Q. 13. By means of a reservoir?

A. No; they have no reservoirs as yet.

Q. 14. Do you know of any plant which is known among hydro-electric interests as the Crane Valley plant?

A. That is generally the San Joaquin No. 1 plant, which is the main plant of the San Joaquin Light & Power Corporation, and is generally known as the Crane Valley plant.

Q. 15. You visited that?

A. Yes, sir.

Q. 16. At what time?

A. I have complete photographs. I visited it about—well, it was early in April, 1912. I could give the date and the day by looking at my record.

Q. 17. This Power Development plant you speak of is located where?

A. It is right at the point where the canyon of the Kern River ends or comes out of the mountains and comes into more or less rolling country.

Q. 18. In what direction from Bakersfield, Kern County, California?

A. My impression is that it is about east, although I think it is more north of east.

Q. 19. And about how far, approximately?

A. I should say 14 or 15 miles. It is a 40-minute ride in an automobile.

Q. 20. Do I understand that that plant is now controlled or owned by the San Joaquin Light & Power Corporation?

A. That is what I understood at the time I visited it.

Q. 21. Now, as to these several plants of this cor-

poration and, particularly, this Kern River Power Development plant you have mentioned, and the plant you have designated as the Crane Valley plant, have you anything to state as to the system of the distribution of the electric energy in regard to the generation of these plants?

Mr. Westall: Objected to as incompetent, irrelevant, immaterial, not proper rebuttal testimony.

A. The system of distribution is a closed loop in which the Crane Valley feeds into one end. You might say a circle, although it is not a circle in actual form; it is a loop. The so-called Crane Valley plant, or San Joaquin No. 1 and No. 3, feed together in one end of this system. I am speaking of the 60,000-volt distribution which is the high voltage distribution going to Bakersfield. They also feed into a secondary distribution at 33,000-volt, which feeds the country around Fresno in Fresno County and in Madera County and Merced County and up into Mariposa County.

Q. 22. Is the Power Development plant you have so designated hooked up with either of these systems?

A. Yes, sir; it is, through the Bakersfield steam plant.

Q. 23. So that the Crane Valley plant and the Bakersfield Steam plant and the Power Development Company plant are on the same system of distribution, or in series, you might say?

A. They work synchronously.

Q. 24. And that being the case, what have you to state as to the effect upon the generators of these several plants of a change in load on the distribution sys-

tem which these plants are incorporated, irrespective of any governing or regulating apparatus?

Mr. Westall: Objected to as vague and indefinite.

A. I do not quite understand your question.

Q. 25. By Mr. Blakeslee: I will put it this way: All of these several plants being hooked up together on this distribution circuit, will or will not the generators of the several circuits be affected and the apparatus for driving such generators be affected by change of load upon that circuit at any point, irrespective of any governing apparatus?

A. They will be affected in this way: Whichever plant is doing the governing would naturally carry the variation in load. If one plant is doing it.

Q. 26. Let us assume that there was no governing apparatus, and we have not so far developed that there is. With such assumption, what will be the effect upon the generating installation at the several units?

A. If there was no way to control the water and they were running along at a certain load and the load should change, if it should increase, the generators would naturally slow down and not carry the load all over the system. If it should decrease, the generators will speed up and tend to more than carry the load.

Q. 27. And in that sense there is a synchronous, sympathetic relation?

A. One station might be connected with a line of so small capacity that the generator at the end of that station would not take this difference in the change of load, or assuming that there is no governing.

Q. 28. But even in that case it would be a matter of degree and there would still be a variation?

A. There would still be a variation.

Q. 29. Is that also true considering the incorporation in that distribution system or circuit of a steam plant at Bakersfield?

A. It is.

Q. 30. Now, as a matter of fact, do you know whether any of these plants in this distribution circuit, including the Power Development station, has any governing apparatus for regulating the generators and the power supplied to the generators of the several stations linked up or linked together in this circuit?

A. I think they are all equipped with governing apparatus, although for the moment I have forgotten what the apparatus is at the Power Development station.

Q. 31. Do you know whether either of those stations have automatic governors?

A. I think they all have, except, as I say, I have forgotten what the machines are at the Power Development Company.

Q. 32. Can you state briefly what the governing apparatus is at the so-called Crane Valley station?

A. It is a Lombard governor; type Q Lombard governor.

Q. 33. And what means connected with such governor is employed for regulating the flow of water to the wheel or wheels?

A. The regulation at the Kern Valley station is different from that at the No. 3 station—the San Joaquin No. 1 station is different from the No. 3—in that they use a by-pass nozzle, whereas they use two needle nozzles, one operating on the wheel and the other acting as

a by-pass. The governor operating these two nozzles operate synchronously.

Q. 34. And what is the relation between the wheel supply and by-pass needle when they are operatively covered?

A. When the governor acts to shut the water off the needle advances in the operating nozzle so as to decrease the size of the opening and cut the water off. And in the same proportion it opens the needle in the by-pass nozzle to let that water by, so that the water that otherwise would go on to the wheel would simply pass by without causing a shock to the piping, or decreasing the speed of the water.

Q. 35. And is the converse true when more water is to be admitted to the wheel or wheels?

A. That is correct.

Q. 36. Then is it correct to state that there is an inverse operation of the wheel supplying needles and the by-pass needle?

Mr. Westall: Objected to as leading and putting words into the witness's mouth, and assuming to read certain language of the patent into the mouth of the witness. I would suggest that he be allowed to select his own words.

A. Yes.

Q. 37. By Mr. Blakeslee: Do you know who furnished these needle-nozzle installations for this so-called Crane Valley plant?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial, and not proper rebuttal.

A. They are Doble machines, and I assume that that they were furnished by the Abner Doble Company.

Q. 38. By Mr. Blakeslee: Do you know when they were furnished?

Mr. Westall: The same objection.

A. I cannot say. Yes, I can, too. They were furnished in 1911.

Q. 39. By Mr. Blakeslee: Please look around the room and see if you find anything which in any respect corresponds to the Lombard governor you have referred to as being connected up with the needles of the installation of this so-called Crane Valley station, or any parts of said Lombard governor.

A. This apparatus before me is what is known as the dashpot, and it is integral with all Lombard governors. (Witness refers to Exhibit W.)

Q. 40. Please state briefly through what parts or features the Lombard governor at this so-called Crane Valley plant exerts its influence or operative effect upon inversely acting needles.

Mr. Westall: The same objection.

A. The needles are operated by a swinging lever. The needles themselves are each mounted on a shaft. The shaft is operated by levers which are connected back to the operating mechanism of the governor, so that when the impulse is given to the main piston which supplies the power in the governor it moves the governor shaft, and through the various links and bell-cranks, moves these needles.

Q. 41. By Mr. Blakeslee: When you speak of shafts, what relation have such shafts to the stems of the needles?

A. I speak of a shaft as a necessary means for con-

veying the power from the governor to the needles as a piece of the mechanism.

Q. 42. I show you blueprints being "Complainant's Exhibit KKK" and "Complainant's Exhibit LL", and ask you to state whether there is any relation between the showing of either of these and the governor and needle installations at the so-called Crane Valley station that you have told us about.

Mr. Westall: All this line of questioning is objected to for the reason before stated, because it is apparently an attempt on the part of counsel to make out his *prima facie* case on rebuttal.

A. I cannot say whether this is the actual drawing of the Crane Valley installation, but it is similar, and, to my mind, shows the connection between the Lombard governor and the two needles that I have described.

Mr. Blakeslee: Let it be shown that the witness in his last answer points to "Complainant's Exhibit KKK."

A. My reference was to give an intelligent description of the connection between power supplied to the governor and the power supplied to the two needles. That shaft is simply a mechanical connection.

Q. 43. Now, with the provision of this Lombard governor assembled and installed in connection with the inversely operating double needle installations at the so-called Crane Valley station, and with that station synchronously and sympathetically connected up with the station of the Power Development Company which you have referred to at the mouth of the canyon of the Kern River, what will be the effect upon the operation of the generators and wheels at said Power Development Company installation, assuming that there is no such auto-

matic governor at such Power Development Company station?

A. I can answer that by telling you how they were operated at the time I visited it, and, I presume, are still doing. The governing of the system was done principally at the Crane Valley station. A small part was done at the steam plant which was floating on the system. The Power Development Company station was not doing any governing at all. They took a continuous, steady load, without any variation of any kind, and simply operated for a certain number of hours each day, and possibly, continuously. At least, there were a certain number of hours at a steady, continuous load.

Q. 44. And how did the wheels operate at the Power Development Company plant in connection with the carrying of this steady, continuous load?

A. The wheels simply carried a perfectly steady load.

Q. 45. And what was the speed of the wheels in carrying this constant load?

A. It was the proper operating speed of the machine. I do not recollect what it was, but it was, maybe, 300 R. P. M. It was the proper speed of the system.

Q. 46. Had there been no such automatic governor or the Lombard governor device, or the like, installed at the so-called Crane Valley station, and no other such automatic governor or any other governor at any point on the synchronous system, including that station and the station of the Power Development Company, what would have been the effect upon the speed of the wheels at the Power Development Company station incident to changes of load upon that synchronous system?

A. The speed would vary, as I explained before, unless there was hand regulation.

Q. 47. As far as the mere regulation of the Power Development Company plant is concerned, and the maintenance of the proper and constant speed of the wheels at that station, is it, or is it not material whether the governing apparatus be installed directly at the Power Development Company station or be more remotely installed upon the same synchronous circuit as that of the so-called Crane Valley station?

A. In the system as they had it connected there would be absolutely no advantage in having any governing apparatus at the Power Development Company station, because that station being a very small part of the entire output of the system, even if it could govern, it would probably not have governing capacity enough to materially affect the system or properly handle the system.

Q. 48. But, more particularly, is there or is there not any difference in the governing efficiency with respect to the wheel of the Power Development Company plant incident to the more remote installation of the governing apparatus, namely, that at the so-called Crane Valley station, or any difference between such governing effect and the governing effect which would be obtained by providing suitable automatic governing mechanism directly at the Power Development Company plant?

A. My last answer, I think, covers that. In a system of that kind the governing is generally done at the master plant, which is the largest plant.

Q. 49. And in so far as the governing of the Power Development Company plant is concerned, speaking of

its governing for the moment specifically, is it or is it not material, or does it or does it not produce any difference in the governing effect in that the governing apparatus is at a remote point on this synchronous circuit?

A. The governing at the Power Development Company's plant, if it were so used, would not handle the system at all. It would be of little value.

Q. 50. It would not handle the entire system?

A. No; and it would be foolish to attempt to govern at that point.

Q. 51. But the governing, if done directly at the Power Development Company plant, would be efficient up to the capacity of that plant, would it not?

A. Oh, yes, provided it would handle the load, which I don't think it would.

Q. 52. Is or is not that regulation effectively taken care of by the Crane Valley plant?

A. That and the steam plant at Bakersfield.

Q. 53. So as far as the efficiency of the governing of the Power Development Company plant is concerned, no further governing is necessary at that plant?

A. None whatever.

Q. 54. Do you know whether the Bakersfield steam plant is operated at all times? That is, during the peak loads, in that synchronous circuit?

A. I think it is, but I cannot answer the question. At the time I was there I think it was operating at all times.

Q. 55. If at any time it was cut out of the circuit, then the governing of the Power Development Company would be effected entirely by the governing mechanism of the Crane Valley plant, would it not?

A. In all probability.

Q. 56. That would be true unless there was some other governor installed at some other plant on the circuit?

A. It could be governed within certain limits at the Tule plant or the No. 3 plant when they operate. The No. 3 plant operates only six months in the year, and the Tule plant only about six months in the year.

Q. 57. Then it would be advisable and proper commercial performance to govern the Crane Valley plant and the Power Development plant together by the sole governing installation at the Crane Valley plant?

A. Yes, sir.

Q. 58. Is that system or method of governing generally employed upon circuits of this same kind where a number of plants at separate points are tied into a single circuit?

A. It is almost universally done, although in other systems, as in the Pacific Gas & Electric system, the governing is not all done at the same plant. It may be done one day at one plant and another day at another.

Q. 59. But is it done usually at any one time at one of the hooked up plants?

A. Provided that plant has the capacity to handle the variations in the governing.

Q. 60. And the preference is to govern at the master plant or plant having the greatest generating capacity?

A. That is generally the case.

Q. 61. In so far as the governing of the Power Development Company plant by means of a remote governing apparatus at the Crane Valley station is concerned,

is it material from the standpoint of efficiency whether or not the Bakersfield steam plant is included in the synchronous circuit or the circuit bridges such plant?

A. Not unless the call for power on the system is greater than the Crane Valley plant can supply.

Q. 62. Unless it is so extreme that the governing apparatus there could not take care of the system?

A. That is the idea. The object of the steam plant floating on the system is not to govern, but to pick up the load in case of a break in the transmission line so as to cut the other plant off.

Q. 63. Now, what is the practice where there are a number of different plants connected up in the same synchronous circuit and governors are provided at the several respective plants for governing from time to time all of the stations in the entire circuit, as to the choice of the station at which at any one time the governing is performed?

A. That would depend on a good many circumstances.

Q. 64. Will you state some of those, please?

A. If all the plants were in a position to draw on the water, the biggest plant or master plant would probably govern. In the case of the Pacific Gas & Electric Company, different plants have a maximum of water at different times. For instance, the De Sabla plant governs and operates the full load during the evening peak when they start in at dark with a full reservoir. They pull on that reservoir till it is pulled down, taking all the power they can get, and do the governing. As soon as that plant has exhausted itself, the governing is put on the Colgate plant. And the Electra plant is like the De

Sabla plant, and has a period of time when it can operate, before it exhausts the water supply, and when it can govern.

Q. 65. Then the selection of the plant which is to govern is predicted upon the condition of the power-supplying medium at that plant, is it?

A. Yes. Let me qualify that. In the Pacific Gas & Electric system, besides their steam plant they have four large hydro-electric plants, each one of them as large as the Crane Valley plant, so that each one of them is capable of governing, either singly, or, possibly, two of them together. It is entirely possible for two plants to govern the system together.

Q. 66. And now, similarly, when the power-supplying medium is fuel, such as oil, and fluctuations in the cost or value of such fuel occur, are such fluctuations taken into consideration in selecting the governing station?

A. They might be. As a matter of fact, at Bakersfield when I visited there the fuel was gas.

Q. 67. And that is relatively cheap?

A. Relatively cheap.

Q. 68. And by what means is the selection of the governing plant affected, and how is such selection put into effect?

A. In this instance of the Crane Valley plant, they have a limited amount of water, due to their canal system. In the summer time this is further limited when the Crane Valley reservoir gets low. At the plant itself there is a forebay reservoir of considerable capacity. It is advisable for them to save all the water they can in that reservoir, and for that reason it pays them to gov-

ern at that point because, if the load should drop off, they can save their water. At the same time, if the load comes on suddenly, they have the water there to supply the extra power.

Q. 69. And how is the saving of water effected by governing at the station where such saving is desirable?

A. If the station governs and the load goes off, the station immediately governs in consequence and the main needle is closed and by the by-pass needle opens. But immediately the differential device operates, it closes the by-pass needle and saves the water without shock to the pipe-line.

Q. 70. I now show you five sketches on separate sheets of paper, being complainant's exhibits respectively "Wilson's Sketch A, B, C, D and E," and ask you if these sketches indicate anything to you generally by their disclosures, and, if so, what?

A. The first sketch, Sketch A, is the double needle nozzle such as we have been talking about on the San Joaquin No. 1 plant, the operating nozzle and the by-pass nozzle operating synchronously. The sketch is only elementary, of course.

Sketch B is an elementary sketch showing the principle of the gates on the so-called Girard wheel, similar to the one used on the Power Development Company when it first was put in. I will say, though, that that is not a true Girard wheel. The by-pass valve shown here is what would be known as a butterfly valve.

Sketch C indicates the gate mechanism of a so-called Girard wheel of the Power Development plant as originally installed with a by-pass valve which, I suppose, you

would call an unbalanced by-pass valve. It is similar to a service cock.

Sketch D would show a mechanism for a main nozzle and by-pass nozzle for a tangential water wheel, the nozzle being of the old fashioned cylindrical type and having a slide valve so arranged that the one nozzle opens when the other nozzle closes, thus accomplishing the result of by-passing the water out of the lower nozzle.

Sketch E is similar in principle to sketch D, accomplished by a slightly different mechanical arrangement.

Q. 71. How many slide valves are there in Sketch E?

A. Two in Sketch E, which accomplish the same result as the one slide valve in Sketch D.

Q. 72. Are you able in any manner to group the several valves of these five sketches in such manner that they shall be classified or generalized as to their types with respect to action and adaptability to be sensitively and responsively operated by governors?

A. The valves in Sketches D and E are both unbalanced valves. That is, they have pressure on one side of them and not on the other, and they would not have an equal action throughout their movement for the reason that as they open the pressure may or may not become more or less on them, and their action would undoubtedly be very erratic. In fact, they would probably "chatter", and they would certainly wear. There is another point about these valves: The way these sketches show, the valves are opening and closing circular orifices. As they are connected together the variation of decrease in the flow of one would not be proportional to the increase of the other one, on the back side where it is closed

and practically no pressure, for the simple reason that the one is uncovering a circular opening, which has a variation of area, and the other is covering it, which also has a variation of area inversely. That would be synchronous in action but not in operation.

Q. 73. They would not be in direct inverse ratio?

A. No. Neither would they in Sketch D. Sketch C would be an unbalanced valve on account of the pressure on it when it is open.

Q. 74. To which valve are you referring?

A. The by-pass valve.

Q. 75. Also the one you refer to as the service-cock type?

A. Yes, sir. Also the increment in opening or decrease in closing would not be uniform in proportion to the opening or closing of the main valves of the wheel so that the control of the water coming out would not be inversely proportional to the water passing through the wheel. The butterfly type of valve shown in Sketch B is a balanced valve, so that the water pressure on the valve tending to open or close it at any time is practically the same. On Sketch A the needles are practically balanced, so that the effort to open or close would be, if properly designed, very nearly even throughout the stroke.

Q. 76. Did I understand you to say that the type of valve shown roughly in Sketch A corresponds to the type of valve installed at the so-called Crane Valley plant?

A. Yes, sir.

Q. 77. Can you further classify the several valves shown in these five sketches with respect to the friction-

al opposition to governing action during play or movement of the valves?

A. Yes. In my description of the valves C, D and E, when I said they were unbalanced in pressure, of course, there is at times a great frictional resistance.

Q. 78. I mean more particularly the valves and the seats with which they cooperate.

A. There is always frictional resistance.

Q. 79. You mean in these types of C, D and E?

A. Yes.

Q. 80. How about the types in A and B?

A. If properly designed there would be frictional resistance, but it would be practically even throughout the stroke.

Q. 81. Would there be any frictional loss in the types in Sketches A and B, as between the seats on the valves and the valves themselves in the operation of the valves?

A. Only the mechanical friction where they pass through the borings.

Q. 82. But as between the needle members themselves and the seats, would there be any friction in the play on the valves?

A. Nothing that is uneven.

Q. 83. Would there be any such friction in the movements of the valves as between the valves and the seats thereof?

A. You are speaking of this point here?

Q. 84. Yes.

A. Of course, there is a certain friction of the water over the surface.

Q. 85. You mean between the specific surfaces of the valves and their seats—the metallic part?

A. Yes, sir. If this valve is properly designed the thrust of the water on one side should be taken up by the reaction on the other.

Q. 86. But as between the metallic surfaces of these valves in Sketches A and B, is there any friction between the valves and their seats during the movement of the valves?

A. In comparison between the two, there would be practically nothing.

Q. 87. And as to the valves you have pointed out in Sketches C, D and E, that is, the unbalanced valves, is there such friction at any time in the movement of the valves?

A. Very great friction.

Q. 88. How much of the time?

A. It would be practically throughout the movement of the valve, although it would decrease as the valve was opened.

Q. 89. What effect upon such friction has the pressure of water on these valves?

A. It causes friction.

Q. 90. Now, with respect to responsive and sensitive governing, which of these groups of valves, if either, shows a preferable organization?

A. I think that the only one that would be considered in governing would be the one on sheet A.

Q. 91. And as to the one on sheet B and contrasting the same with sheet A, what have you to say?

A. The one on B could be used, so far as friction

goes, but it would not govern the water with the regularity that the one on sheet A would.

Q. 92. The frictional element would be missing?

A. Yes, sir.

Q. 93. Would it or would it not be more advantageous than those on sheets C, D and E?

A. It would be very much more so on B than on C, D and E.

Q. 94. Have you had occasion to put into use or use Lombard governing devices, including the dashpot and attendant features, such as shown in "Complainant's Exhibit W."?

A. I have.

Q. 95. Have you ever installed such Lombard governing devices?

A. I have

Q. 96. In connection with hydro-electric plants?

A. Yes, sir.

Q. 97. Have you ever governed such plants through such governing devices?

A. I have.

Q. 98. That is, giving your attention to the operation thereof?

A. I have.

Q. 99. Have you at any time installed one or more complete hydro-electric plants with such governing devices?

A. Yes, sir.

Q. 100. What has been your general experience for the last ten years or so in the hydro-electric field?

A. I have designed and built hydro-electric plants and systems and operated them.

Q. 101. Can you name some of the companies and stations in connection with which you have done this work?

A. I have designed and built three plants that are now part of the Pacific Gas & Electric system, and the master plant of the Northern California system, and other plants, besides acting as consulting engineer on a number of others.

Q. 102. Are all of these plants using Lombard governors such as those you say you have installed, including features like those of "Complainant's Exhibit W"?

A. Not all of them.

Q. 103. How large a percentage?

A. The Coleman plant of the North California does not use it. They used it on other parts of the system. The Pacific Gas & Electric Company use Lombard governors on all their plants.

Q. 104. How about the other plants?

A. Yes. I have just completed the installation of a Lombard governor.

Q. 105. And the other plants?

A. With the one exception which I mentioned

Q. 106. Does your connection with it go back beyond ten years?

A. Yes, sir; about eighteen years.

Q. 107. I show you a bottle of fluid marked "Complainant's Exhibit Bottle of Kern River Water at Power Development Company Plant," and ask you, from such inspection as you can make, how the physical character of this water compares, generally, with the water of other creeks, rivers and streams in California, used in operating hydro-electric plants with which you have had ex-

perience, particularly as to freedom from solid or semi-solid contents?

A. Well, I have been on the Kern River on two different occasions at different times of the year, and in both instances the water was absolutely clear.

Q. 108. How has your experience with the water as you found it there compared with the water of other streams?

A. There is a great variation in the quality of water of other California rivers during the different parts of the year, but the more northerly rivers have more or less debris and the water is not clear. Take the rivers up to and including the Tuolumne, the water is fairly clear. From there on up you get more or less of the effects of hydraulic mining even today, and the water in the winter time is always yellow, till you get to Shasta.

Q. 109. And is the Tuolumne stream that you speak of substantially in the same latitude as the Kern River?

A. No; the Tuolumne is not always clear.

Q. 110. The same latitude?

A. No, no. It is farther north.

Q. 111. How does the water in this exhibit from your brief examination compare as to clearness or limpidity with the water of other California streams used for hydro-electric plants?

A. Well, it is very much clearer than most of the rivers would be at this particular time of the year.

Q. 112. Do the other plants have any material trouble in utilizing the more cloudy or soiled water supplied to them?

A. A very few of them.

Q. 113. Would you expect any difficulty in operating properly designed hydro-electric plants with water of the character of this exhibit?

A. None whatever.

Mr. Blakeslee: That is all.

CROSS EXAMINATION.

By Mr. Westall:

XQ. 114. You have made the remark in answering one question, that you did not think that the water ^{wheel} in use at the Power Development Company's plant at the Kern River Canyon could not handle a change of load, even with an efficient modern form of governor. Will you please explain a little more fully what you had in mind?

A. The wheels are not of sufficient capacity.

XQ. 115. And what do you mean by "not of sufficient capacity?"

A. The change of load on a system of the size of the San Joaquin Light and Power Company's system might be very much greater than the capacity of the combined machines of the Power Development Company station. For instance, supposing the San Joaquin system were using 25,000 horse-power and there should be a sudden change of load of 8,000 horse-power. That is, the load would pick up 8,000 horse-power. The wheels at the Power Development Company's plant could not pick up any such load as that. Their total capacity is only about five or six hundred horse-power. So that they, as a factor in the governing of that system, would cut very

little figure. In fact they could not be used to govern the system.

XQ. 116 You have stated that in your opinion the apparatus attempted to be illustrated in "Complainant's Exhibit Wilson Sketch B" would not be as efficient, if I may use the word, for the purpose for which it is evidently designed, or for governing, as that illustrated in "Complainant's Exhibit Wilson Sketch A." Will you please explain why you would not consider the device shown in Sketch B as efficient as that shown in Sketch A?

A. Let me ask a question. I understand that I am on the witness stand as a witness and not to give expert testimony. In my explanation of that before, I gave the explanation that the opening of this by-pass is not a synchronous opening with the opening of these gates. For this reason the by-pass will not by-pass in exact inverse proportion to the opening of those gates. I thought I made that clear when I explained it before. That, of course, is on the basis of this sketch. I do not mean to say that this could not be so constructed or designed that the desired effect might be reached. But not according to this sketch.

XO. 117. Then would you say that the butterfly valve for the control of the by-pass, arranged in a manner resembling that, would be as efficient as the device attempted to be shown in Sketch A?

A. I did not say that it would be as efficient as Sketch A, under any consideration.

XQ. 118. Will you please state why?

A. That brings me into a technical explanation.

Mr. Blakeslee: The present witness, so far as he has been examined, was examined as to questions of fact

pertinent to the various installations ~~and~~^{of} various devices and suggested devices, and has not been examined as an expert witness for the purpose of expertation. He has stated how these various valves operated or would operate, and it is not believed that the question is proper which goes into pure expertation. If counsel persists in this inquiry, he is making the witness his own and we object to this line of questioning as not warranted by the direct examination, and as not cross-examination.

Mr. Westall: Do I understand from counsel's remarks that he wishes to be understood as taking the position that this witness is not qualified and has not been qualified to testify as an expert concerning these various sketches about which he has been interrogated?

Mr. Blakeslee: On the contrary, we contend that he is most expert and qualified, and, aside from that, counsel can take my remarks as he wishes.

Mr. Westall: Then if the witness has been properly qualified and no question has heretofore been raised as to that point, I will ask that the question be repeated and that it be answered by the witness, if he is able to do so.

Mr. Blakeslee: Very well. If counsel insists on making an expert out of this witness for the purpose of expertation by giving testimony, he makes the witness his own and he can arrange with the witness for compensation of the witness as such expert.

Mr. Westall: Counsel for defendant suggests that the witness has been called to testify as an expert for plaintiff and is now being subjected to cross-examination.

Mr. Blakeslee: That is a miss-statement. I did not so state. I said his examination has to me proven that he is an expert in his line, but he may be an expert in

this line and at the same time he may play tennis, and in so doing he is not acting as an expert, although able to.

Mr. Westall: Counsel for defendant suggests that if the witness is reluctant or will not answer proper questions as to these sketches which have been fully inquired about on direct examination, that he will ask the court that all of the direct testimony concerning the sketches be stricken out and withheld from consideration by the court.

Mr. Blakeslee: Do as you please.

Mr. Westall: The Examiner is asked to repeat the question.

Mr. Blakeslee: We notify the witness that if in his good judgment he believes that he is being examined by counsel for defendant as an expert, he may refuse to serve as such expert without making arrangements with counsel for defendant to act as his expert. So he may protect himself as he deems best under the circumstances.

A. Well, I think that the question as asked is leading into the question of design for efficiency, and it might take considerable time to practically give a technical explanation of why the butterfly by-pass must be treated somewhat differently from the needle by-pass in order to get the desired effect, the two being in one class, as against the Sketches C, D and E, which are in an entirely different class, the first two being balanced valves, and C, D and E not being balanced valves.

Mr. Blakeslee: And all my questions were directed to questions of fact relating to the friction and water pressure, and so forth.

A. The questions I have answered so far are questions of fact and not questions of opinion or calculation. If I am supposed to act as an expert witness as to the various types of design, I do not think under the present conditions I should be asked that.

Mr. Blakeslee: And you need not do so, since you are the witness for complainant, unless you make arrangements to that end with counsel for the defendant.

A. I would be very glad to answer questions of fact, so far as they are within my knowledge and ability to do so.

XQ. 119. By Mr. Westall: And do I understand that you have not the knowledge to answer the question as put?

Mr. Blakeslee: We object to that question as frivolous.

Mr. Westall: Change that.

XQ. 120. Do I understand that you take the position that you have not the necessary knowledge or inclination to answer the question that has been put?

A. I certainly have it, if it is necessary to give it.

Mr. Westall: The witness having under the direction of counsel refused to answer or to respond to proper cross-examination as to the sketches which were fully inquired about upon direct examination, it is moved that all the testimony of the witness regarding these sketches and making these comparisons be stricken out and withheld from consideration of the court, and notice is given to counsel that at the time of the argument this motion will be presented and insisted upon.

Mr. Blakeslee: It will be taken up at the same time as the motion presented to strike out certain portions,

if not all, of the deposition of the witness Berry, on the ground that he was coached by counsel for defendant and others, while on the stand.

Mr. Westall: I believe that is all.

REDIRECT EXAMINATION

By Mr. Blakeslee:

RDQ. 121. Is there or is there not any reason why the Power Development Company plant which you previously referred to could not or cannot be governed alone or by itself, if, for instance, it were severed from the other plant or plants upon the synchronous circuit in which it is now included?

Mr. Westll: Objected to as not proper redirect examination.

A. There is no reason why it could not be governed providing it has proper governors.

Mr. Blakeslee: That is all.

Office of George J. Henry, Jr.,
737 Rialto Building.

San Francisco, Cal., Monday, February 22, 1915.

10 o'clock a. m.

By consent of counsel an adjournment is now taken until tomorrow, February 23, 1915, 10 o'clock a. m.

Office of George J. Henry, Jr.,
737 Rialto Building.

San Francisco, Cal., February 23, 1915.

10 o'clock a. m.

This being the time and place to which the further taking of testimony in rebuttal on behalf of complainant was continued, proceedings are now resumed.

Present:

Raymond Ives Blakeslee, Esq., solicitor for complainant.

Joseph F. Westall, Esq., solicitor for defendant.

Mr. Blakeslee: Counsel for complainant states that it is impossible to obtain the attendance of the witness desired to be examined on behalf of complainant, and therefore asks that an adjournment be taken until 2 o'clock p. m.

Mr. Westall: Counsel for the defendant wishes the record to show that he protests against the delay in the taking of these depositions, and objects to the failure on the part of complainant to take steps to procure the attendance of witnesses. Counsel states that on Friday last he consented to an adjournment over Saturday on the promise that witness would be present on Monday morning at 10 o'clock. Instead of there being any wit-

nesses present there was no one present at the time to which we adjourned but the Examiner and counsel for the defendant, and there was no notification that further adjournment would be requested. Counsel for complainant is reminded that attendance at San Francisco involves a great deal of expense, and that this long delay could have been avoided by taking steps on Friday last to compel the attendance of witnesses by subpoena. During the taking of defendant's testimony during the cross-examination of the witness Cobb it became necessary to adjourn the proceedings to a day other than had been ^{7.}therefore agreed upon. On page 726 of the record, under [^]date of April 14, 1913, appears the record of many strenuous objections that were interposed by counsel for complainant when that adjournment was requested, although in that case counsel for complainant had been previously advised that the adjournment would be asked, and the Examiner had been so advised. In order to save space in the record, all objections which were interposed by counsel for complainant to the adjournment of April 14, 1914, (record page 726) will be understood as being adopted, so far as proper and pertinent to the present situation here, without being specifically recopied into the record.

Mr. Blakeslee: In response to counsel's objections just made on the record, it is to be noted that we have been laboring under a difficulty with respect to the production of witnesses during this session of taking testimony in this city, consisting in the occurrence of three legal holidays in this city incident to the opening of the San Francisco Exposition. We crowded the testimony of four witnesses into Friday of last week, and

made strenuous efforts to obtain other witnesses to follow, but the legal holidays themselves, coupled with a severe throat trouble of counsel for complainant which made it impossible, almost, for him to talk intelligibly, made it necessary for us to take an adjournment until this morning. This morning we were unable to obtain a witness, and attempted to obtain other witnesses for this afternoon, and the endeavors to do which have resulted in obtaining a witness who will be here presently. The court will appreciate the difficulty counsel labors under in obtaining the witnesses in traveling from place to place and taking proofs of this sort, all of which is fully covered by the stipulation in this case and usual practice in such matters. As for subpoenaing witnesses, it is pointed out that it is rather difficult to obtain subpoenas when the courts are not in session and the clerk's office is closed due to the legal holiday observations, and there have been three such holidays prior to today. Counsel is here and has consented to the adjournment and the record speaks for itself.

(Whereupon an adjournment was taken until 2 o'clock p. m., at this same place.)

February 23, 1915, P. M.

ARTHUR H. HALLORAN, called as a witness on behalf of complainant, being first duly sworn according to law to testify the truth, the whole truth and nothing but the truth, testified in rebuttal as follows:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 1. Please state your full name, age, residence and occupation.

A. Age, thirty-two; residence, Berkeley, California; occupation, manager and editor of The Journal of Electricity, Power & Gas.

Q. 2. Where is that publication edited and printed?

A. It is edited and printed in San Francisco.

Q. 3. How long have you been connected with that publication in the capacity which you have stated?

A. Seven and three-quarters years.

Q. 4. Without interruption?

A. Without interruption.

Q. 5. What opportunity have you to receive direct knowledge of the publication and issuance of the consecutive volumes and numbers of volumes of that publication?

A. I have complete charge of the editorial matter that goes into that paper, and have had during that period.

Q. 6. In what manner are you apprised of the issue of each number? That is, the publication of the same.

A. I do not understand your question.

Q. 7. In what manner, if any, are you notified as to the printing and issuing or publishing of the numbers of this publication?

A. By the fact that I have charge of the manuscript, its editing, proof reading, making the dummy for the paper, ordering paper for the printing to be done, and

receiving the first copy of the paper that comes from the press.

Q. 8. And are you also advised as to the distribution of the published volumes?

A. Yes sir.

Q. 9. How often are these numbers issued?

A. These numbers are issued weekly.

Q. 10. I now show you what purports to be a copy of a publication entitled "Journal of Electricity, Power and Gas," Volume No. XXVIII, (twenty-eight) in Roman characters, and No. 19, Arabec characters, and ask you if you know anything about this book?

A. This is the regular issue of that publication on that date. This particular number was taken from our office files and is a complete and unchanged copy in every respect.

Q. 11. What date was it published upon?

A. May 11, 1912.

Q. 12. Is this the same Journal of Electricity which you have testified as to your connection with?

A. It is the same paper.

Q. 13. And this is an exact copy of this number which was published, issued and distributed at and from the city of San Francisco, California?

A. Yes, sir.

Q. 14. Approximately what is your circulation?

A. Twenty-five hundred.

Q. 15. What is the field of its circulation principally?

A. Among the engineers and electric power and light companies in the territory west of the Rocky Mountains.

Mr. Blakeslee: We offer in evidence this number of

the said publication as "Complainant's Exhibit Copy of Issue of May 11, 1912, Journal of Electricity, Power and Gas."

Mr. Westall: May I ask counsel the purpose and object of producing and offering the evidence, and what it is designed to prove?

Mr. Blakeslee: In connection with the offer and with the inquiry of counsel we will state that the offer pertains, as to the contents of this issue, to the first or leading article entitled "San Joaquin Light & Power Corporation," and that the remaining contents of the book are not within the offer other than to make a complete offer of the publication and in order that it may be a genuine and full specimen of the issue of the number of which this is a copy. And, further, in order to show the court that it is common knowledge by means of this publication that the plant referred to in these proceedings as the Power Development Company plant and the plant referred to in these proceedings as the Crane Valley plant are connected up together in a synchronous system of electrical distribution under the control of a governor of the Lombard type including features such as that embodied in "Complainant's Exhibit W," as testified by the witness Van Norden, who appeared on behalf of the complainant in rebuttal.

Mr. Westall: Counsel for defendant objects to the evidence and to the purported copy of the Journal of Electricity, Power and Gas, just offered in evidence, as incompetent, irrelevant, immaterial, and not proper rebuttal, and as an improper method of proving any of the statements contained in the article referred to by counsel, as consisting merely of hearsay and as not affording

counsel for defendant any opportunity to cross-examine the writer of the article, and as not being the best evidence, there being no foundation laid for any copy of the original purported copy of the article referred to.

Mr. Blakeslee: In response to counsel's statement, we will say that we are about to call the writer of this article who may be cross-examined as to the preparation of the article in question.

Mr. Westall: The calling of the writer of the article would not obviate the objection. It is here attempted to get the article written by the witness in as a direct deposition apparently by him, and to now offer to produce the alleged writer for cross-examination would not and cannot obviate the objections which have been made.

Mr. Blakeslee: It is further to be noted that this witness has been on the stand before and counsel has had an opportunity to cross-examine him as to the matters of this article.

Mr. Westall: Counsel for the defendant is not informed as to what the contents of the article may be and confined his cross-examination only to the matters brought out on direct examination so far as appeared pertinent.

Mr. Blakeslee: Of course, the publication is a publication, and that is as far as this exhibit itself goes, and what we are proving by this witness as to the publication of this article, and not the literary subject matter.

Mr. Westall: If the only object was to prove that such an article was published, then the objection is reiterated that it is entirely incompetent, irrelevant, immaterial and not in rebuttal.

Mr. Blakeslee: We will make the contents of it relevant, material and competent in so far as it is not now, if that be the case. We have called attention of counsel for defendant to the fact that the subject matter of this article has been testified about by one witness, and the facts have been testified to by two during these rebuttal proceedings, and the purpose of offering the publication is manifest.

(The said publication so offered in evidence is marked "Complainant's Exhibit Copy of Issue of May 11, 1912, of Journal of Electricity, Power and Gas," together with the title of the court and cause and the date upon which the said exhibit was offered in evidence.)

Q. 16. By Mr. Blakeslee: Referring to this first article in this Journal of Electricity, Power & Gas, the number of May 11, 1912, do you know who prepared the copy or manuscript of this article entitled "San Joaquin Light & Power Corporation?"

A. Rudolph W. Van Norden.

Q. 17. Do you know who he is?

A. A consulting engineer of San Francisco.

Q. 18. Is he present in the room at this time?

A. Yes, sir.

CROSS-EXAMINATION

By Mr. Westall:

XQ. 19. How long has the publication to which you have referred been called the Journal of Electricity, Power and Gas?

A. Since September, 1895.

XQ. 20. What was it called before that time?

A. It was originally established in 1887 under the name of "Pacific Lumberman, Contractor and Electrician."

XQ. 21. How long did it go under that name, if you know?

A. I don't know how long it was published under that name.

XQ. 22. What was the next name that it was known under?

A. The Journal of Electricity.

XQ. 23. For how long a time and when was it known under that name?

A. My statements in the past have been erroneous. It was entered as second class matter at the San Francisco post office as the Electrical Journal in July, 1895. It was changed to the "Journal of Electricity, Power & Gas," August 15, 1899. Entry changed May 1, 1906, to "Journal of Electricity, Power and Gas, Weekly."

XQ. 24. What has been the character of this publication as to the contents and as to the reliability and circulation since it was first known as the Electrical Journal, if you know?

Mr. Blakeslee: Objected to as not cross-examination, in so far as it takes into consideration a period prior to the year 1912.

A. Its contents have been principally technical records of the hydro-electric development of the western states. Its articles have been written by leading engineers of this territory, and the paper has a high standing as a technical magazine.

XQ. 25. What have you to say as to the circulation during the time I have mentioned?

Mr. Blakeslee: Objected to on the same grounds and the apparent attempt of counsel to bolster up the defense's case with respect to the publication of this name or some similar name.

A. During the period of time I am personally familiar with the circulation, it varied from 2,000 to 3,000 copies weekly.

Mr. Westall: I believe that is all.

REDIRECT EXAMINATION

By Mr. Blakeslee:

RDQ. 26. How early a date can you give as that covering your own personal knowledge as to the nature of this publication, its field and its contributing writers?

A. My personal connection with the paper has extended since April 20, 1907, seven years prior to that time I saw the publication regularly as issued, but had no connection therewith.

Mr. Blakeslee: That is all.

RECROSS EXAMINATION

By Mr. Westall:

RXQ. 27. Then you saw it when it was known as the Journal of Electricity did you?

A. I have in my possession bound volumes of the paper.

RUDOLPH W. VAN NORDEN, a witness heretofore produced and sworn on behalf of complainant in rebuttal, being recalled on behalf of complainant in rebuttal, further testified for complainant in rebuttal as follows:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 122. You have testified previously in this case with respect to a certain synchronous system of power distribution known as that of the San Joaquin Light & Power Corporation, in the State of California, such system including the plants known as the Crane Valley station and the Power Development Company or Power, Transit & Light Company station, located near Bakersfield, California, at the point where the Kern River leaves the canyon. Have you at any time ever prepared any article for publication dealing with that subject?

A. I have.

Q. 123. When did you prepare such article?

Mr. Westall: Objected to as incompetent, irrelevant, immaterial and not proper rebuttal.

A. April, 1912.

Q. 124. By Mr. Blakeslee: Do you know what was done with this article when you prepared it?

Mr. Westall: The same objection.

A. It was published in the Journal of Electricity, Power and Gas, on May 11, 1912.

Q. 125. By Mr. Blakeslee: Where was that publication made?

A. In San Francisco, California.

Q. 126. I call your attention to "Complainant's Exhibit Copy of Issue of May 11, 1912, of Journal of Electricity, Power and Gas," and ask you if this is a specimen of the publication of date of May 11, 1912, to which you have just referred?

Mr. Westall: The same objection.

A. It is.

Q. 127. By Mr. Blakeslee: Is the article in this publication entitled "San Joaquin Light and Power Corporation" which purports to have been written by Rudolph W. Van Norden the article you refer to?

Mr. Westall: I object to the method of proving the article or the contents thereof, and also the objections as heretofore interposed to the subject matter are repeated.

A. It is.

Q. 128. By Mr. Blakeslee: Does this article in any portions of it relate to the governing of the said Power Development Company's plant and the governing of the Crane Valley plant simultaneously or synchronously by means of a governor you referred to in your previous testimony as being installed at the Crane Valley plant?

Mr. Westall: Objected to for the reason that the purported article speaks for itself as to what it refers to, and as an improper method of proving the contents of the article or any of the statements made in the article or the subject matter thereof.

A. The article describes the type of the governors and method of governing, and also the fact that the various plants operate in synchronism.

Q. 129. By Mr. Blakeslee: Please refer to this article and quote briefly excerpts therefrom bearing upon these points.

Mr. Westall: The same objections are repeated.

A. On page 439, beginning with the top of the second column, it reads as follows:

"There are four main generating units. The generators are General Electric 4,000 k.v.a., 2,300 volt, 3-phase,

and operate at 400 r.p.m. The water wheel is a single overhung Doble runner enclosed in a cast-iron housing and is equipped with two needle nozzles. The upper or main nozzle is operated by a type Q Lombard governor. The lower nozzle is a by-pass and opens when the main nozzle closes, thus removing the water from the wheel without shock to the pipe lines. The automatic mechanism gradually closes the by-pass needle so that water may be conserved when it is not in use on the wheel."

Q. 130. By Mr. Blakeslee: To which plant does this excerpt refer?

Mr. Westall: The same objection.

A. The San Joaquin No. 1, commonly known as the Crane Valley plant. On page 442, about the middle of the first column, in speaking of the Power Development plant at the mouth of the Kern River canyon and its connection into the transmission system and with the San Joaquin plant, is the following:

"A two-circuit transmission line conveys the current to Bakersfield, where it is synchronized with the other 10,000 volt circuits in this district."

Q. 131. By Mr. Blakeslee: Is there any illustration in this article which shows diagrammatically or otherwise the inter-relation of these stations in this synchronous system and the connection of one with the other, subject to the governing by the Crane Valley plant?

Mr. Westall: Objected to for the reason that the purported article speaks for itself as to what it contains, and also on the ground that the question calls for not the best evidence as to the location and inter-relation of the different plants, and the previous objections as to

to this pamphlet and this article and as to the contents thereof are repeated.

A. On page 429 is a map of the San Joaquin Light & Power Corporation's system in which the various transmission lines are plainly shown, and the connections between the Crane Valley plant and the Kern River plant. On page 439 is a general view of San Joaquin No. 1, or Crane Valley power house, and on the following pages are interior views of which one shows distinctly the type Q Lombard governors. On page 441 is a view of the Kern River plant.

Mr. Westall: Defendant moves that all that part of the answer beginning with "On page 439" be stricken out as not responsive to the question, and as incompetent, irrelevant and immaterial.

Q. 132. By Mr. Blakeslee: Are these two pictures of the plant you refer to the same plants that you have testified about last in this case, referred to generally as the Crane Valley plant and the Power Development Company plant, or Power, Transit & Light Company plant?

A. They are.

Q. 133. I note on page 441 of this article in the second column the following matter:

"Between the hydraulic gates and the water wheel are butterfly valves which are operated by a cast-iron hand wheel and column."

This matter appearing under the heading "Kern Canyon Power Plant." Are these the same butterfly valves, hand operated, which you referred to in your testimony last Friday in this case in describing that plant?

Mr. Westall: Objected to as leading, and also for the reasons hereinbefore stated, as not the proper method of proving the contents of the purported article in question, and as not the best evidence.

A. I think these are not, as these butterfly valves are in the main feeder line, but I am not sure on that point.

Q. 134. By Mr. Blakeslee: If I am mistaken in your testimony in these respects, I have confused it with the testimony of some other witness. Please state whether or not this refers to the method of control of the supply of water to the wheels at that plant, that is, this quoted matter?

A. You mean in the article?

Q. 135. Yes.

Mr. Westall: Objected to as assuming that the witness is able to read the mind of counsel and find out in what respect he is mistaken and that it is otherwise incompetent, irrelevant and immaterial and also leading.

Mr. Blakeslee: The witness does not have to read my mind. All he has to do is to read the quoted matter and tell us whether or not that refers to what I have asked.

A. The butterfly valves are in the main feed line between the hydraulically operated valve and the water wheel.

Mr. Blakeslee: That is all.

Mr. Westall: Cross-examination waived.

GEORGE J. HENRY, JR., complainant herein, previously sworn, being recalled on behalf of complainant in rebuttal, testified as follows:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 478. Do you know of a certain hydro-electric plant or station known as the Power Development Company plant or Power, Transit & Light Company plant, situated about 16 miles from the city of Bakersfield in the County of Kern, California, at the mouth of the Kern River Canyon?

A. I do.

Q. 479. Have you ever visited that plant?

A. Yes, sir; I visited the plant several times.

Q. 480. When did you last visit it?

A. On Thursday of last week, February 18.

Q. 481. In whose company did you visit it at that time, if anybody?

A. In the company of Mr. J. F. Dearth who had formerly operated the plant a number of years, Mr. Benjamin the Examiner, Mr. Blakeslee my attorney, and Mr. Westall, attorney for defendant.

Q. 482. Did you make an inspection of that plant on the occasion of that visit?

A. I did.

Q. 483. How long were you there?

A. We were there approximately six hours, during which we examined it as thoroughly as possible to examine a plant outwardly without taking to pieces the various parts or getting into the wheel housings.

Q. 484. Was any deposition taken on behalf of yourself, complainant in this case, at the time of that visit at that plant?

A. Yes, sir; the deposition of J. F. Dearth was taken

at that time and I was present during the taking of most of it.

Q. 485. You heard the deposition, did you?

A. I did.

Q. 486. Have you also read the depositions of Edward S. Cobb, S. L. Berry, B. C. Van Emon and J. A. Lighthipe, witnesses produced on behalf of defendant in this case?

A. I have, and I have also heard the deposition of the witness Sessions and Carroll N. Beal given on Friday of last week in my presence in connection with this same plant.

Q. 487. Please state how many generator units you found installed at that plant last week.

A. Three main generator units, each operated by a water-wheel unit.

Q. 488. Please give a general summary of the system and method of control of the water-wheel units of said three generators in vogue or in use at that Power Development Company plant when you were there last week.

Mr. Westall: Objected to as incompetent, irrelevant, immaterial and not proper rebuttal.

A. The only automatic method of control of the units in this station is in the combination with an electric transmission system. The generators of this station run in synchronism with and feed into the main supply lines of the San Joaquin Light & Power Company supplied by other plants. In one or more of the other plants automatic governors are provided to take care of the load fluctuations on the system. No automatic governing devices are provided within the station which we visited,

the system depending for its automatic control upon modern governors and water-wheel nozzles located in other stations supplying this same system and running in synchronism with the Power Development Company plant which we visited.

Q. 489. By Mr. Blakeslee: In so far as the governing of this plant is concerned is it or is it not material whether the actual governing apparatus is installed directly in or at this Power Development Company station or at a remote point, as at one of the other power houses which you have mentioned, which are connected up together in this synchronous system of distribution which you have referred to?

A. The common practice is to do the automatic controlling on one or more of the units, of which there may be many, feeding into such a synchronous system. It is a well recognized method adopted in all power transmission systems today. In the early days of electric power transmission there was usually but one plant feeding into a single transmission line, in which case it was necessary to automatically control at least one or more of the units in the power station, if accurate speed control was to be maintained, as was always desirable.

Q. 490. Then can it be truthfully said that this Power Development Company plant is governed or controlled at the present time by a modern governor or is it not?

A. Yes, sir; it can be truthfully said that it is so controlled by automatic governors located in other plants feeding into the same lines. Automatic control from the observation of the lights in Bakersfield to which this system supplies power would indicate a very satisfac-

tory speed control of the water-wheel units. This speed was maintained during such time as I visited the plant in question very accurately, as indicated by the tachometers which were driven from each of the water-wheel units. Had any variation of speed occurred in these generators due to insufficient or inefficient governing by the plant which was governing on the system, it would have shown itself by a variation of the speed in the units in this plant. These variations in ordinary practice occur many times a minute in ordinary times, and, therefore, a 6-hour observation of the plant and the observation of the lights in Bakersfield during a period of two hours would indicate with a good degree of positiveness the accuracy of governing being maintained on the system.

Q. 491. Do I understand in your last answer that the lights in the city of Bakersfield to which you refer are energized by electricity generated at this Power Development Company plant?

A. They are energized from electricity supplied from a circuit, which circuit is supplied by the Power Development Company's plant and others, the automatic regulation being provided on the other plants feeding into the system.

Q. 492. So that I understand there is a certain what we may term fund of electrical energy which is drawn upon for the energization of the lights in the city of Bakersfield, and the Power Development Company contributes to the upkeep of this fund, and the Power Development Company with the other plant contributing to such upkeep of this fund are all governed at one or more

stations than the Power Development Company. Is that correct?

A. That is a correct statement.

Q. 493. Please briefly state what if any means were employed last week at this Power Development Company plant for determining the supply of water to the several wheel units.

A. The method installed apparently and that which had apparently been installed for a very long time, judging from the condition of the parts, and the design of the various elements was that of introducing a butterfly or balanced-type of valve—the frictionless type—located in the supply pipe between the main hydraulic gate and the water-wheel nozzles, such that by shifting the butterfly valve in the said pipe, the butterfly valve would permit a greater or less flow of water to the nozzles of the corresponding wheels.

Q. 494. How was such actuation of such butterfly valves produced?

A. The butterfly valves were each mounted upon a spindle or shaft extending across the diameter of the feed pipe, and on this shaft was mounted a worm gear into which meshed a worm wheel which was mounted upon a suitable shaft, carrying also a hand wheel at one end, and through suitable gearing could be operated from the wheel before mentioned or from a secondary hand wheel located at a remote part of the floor and adjacent to the switchboard, so that the station operator close to the main switchboard might by rotating this second hand wheel from each or any of the valves shown, operate its corresponding valve and reduce or increase the quantity

of power being supplied to the water wheel by varying the current of water flowing thereto, and thereby varying the power supplied by the water wheel to the generator, and the generator to the electric distribution system.

Q. 495. In connection with the pipe-line for supplying water to the wheels of this plant did you find any relief means or devices last week?

A. Yes; there is a relief means located outside of the power house consisting of an entirely independent valve operated entirely independent of any by-pass valve, with connections so that it may also be operated from an independent point near the switchboard, so that in the event of its becoming necessary to quickly close off the water flowing to any or all of the water wheels in this station, the relief valves might by a separate movement of the hand controlling device be opened to admit or discharge the water so as to prevent a water ram in the pipe-line.

Q. 496. And is that relief valve operated in mechanical unison with any other valve in that plant?

A. Not by any inter-connection with other valves. It requires separate and distinct operation on the part of the operator.

Q. 497. And how does he affect such operation? That is, by what sort of control?

A. The relief valve mentioned is located outside of the power house and is actuated by a lever located near the switchboard inside of the power house.

Q. 498. And that lever is worked how?

A. That lever is operated by hand. Subsequent to the opening of said relief it would be proper to close the

other end or all of the butterfly valves controlling the flow of water to the water wheels. In this way suitable relief is provided to prevent a dangerous water ram in the pipe-line upon the closure of the main control butterfly valve.

Q. 499. Is there any governing now in that plant which either separately or jointly controls the operation of these three butterfly valves and this outside relief valve?

Mr. Westall: All these questions and this line of questioning is objected to as incompetent, irrelevant and immaterial. The precise construction and arrangement of the valves in the plant referred to can have no pertinence to any issue raised in this case at this late period, so many years after the time at which the anticipation set up in the answer was proven to have been in use.

Mr. Blakeslee: We call the attention of the Examiner to the new equity rules and the provisions thereof in respect to argumentative matter introduced by counsel in the course of taking proof, and ask that he bear in mind such rules in transcribing the record.

A. There is no automatic governing of any kind on any of the water wheels in this station, nor any device which could perform any automatic functions governing the water power equipment.

Q. 500. By Mr. Blakeslee: That is, I take it you mean to state directly at this station?

A. Yes. This testimony refers specifically to the apparatus in this station.

Q. 501. Did you or did you not find upon the pipeline of this plant last week any other device which has

or might have any effect upon pressure conditions in the pipe-line?

Mr. Westall: Objected to for the reasons heretofore stated.

A. Yes; there is an air-chamber mounted upon the distributing drum or head at the end of the pipe-line immediately outside of the power house, and from which the water wheels are supplied with water. This air-chamber is a well-known device in the early art for absorbing inertia effects produced in a moving water column upon the movement of valves to vary the velocity of the water flow.

Q. 502. By Mr. Blakeslee: Did you find any other device or apparatus installed at or in connection with the pipe-line at the plant last week for regulatng the speed or supply of water to the plant?

A. Yes; there were several other devices which are used by operators in controlling the water at this station. There are hydraulic valves located in each pipe branch in addition to the butterfly valves above mentioned, each of which is controlled by its own independent hydraulic connections and hand lever from a point near the switchboard, so that any of these may open or close from the switchboard location. There is also provided at the pipe inlet a float and indicator device which is observed through a telescope mounted inside of the power house by which telescope the operators observe the exact stage of the water at the pipe intake in order to more intelligently shift the valves by hand to utilize to the most efficient degree the water supplying the plant.

Q. 503. During this visit to this plant last week did

you find any by-pass or relief devices upon the feed pipes at or adjacent to the wheel cases?

Mr. Westall: The same objection will be understood as repeated after each and every of the questions concerning the precise and exact construction of the plant.

A. There were no relief valves or devices in operation or connected in any operative manner with any of the wheels in this plant, although there were by-pass outlets which were sealed or closed in a fixed manner with plates indicating that there might possibly at an earlier date have been intended to be installed here some form of by-pass valve.

Mr. Westall: I move to strike the answer out as being almost entirely based upon guess and conjecture and not upon facts. The witness can state what he observed, and his conclusions and guesses and surmises as to what he testifies to are for the court and not for the witness.

A. I desire to correct my last answer if it implied in any way the possibility of any operative device having been connected on the feeder pipes to these water wheels for the purpose of water relief, as I do not consider that there was any evidence in these pipes of any operative device being possibly connected thereto. There appeared to be outlets in each of the pipes which were sealed over and closed. There was no operative connection or operating connections of any kind in connection therewith.

Q. 504. By Mr. Blakeslee: Then as I understand it, in order to clothe these various sealed outlets with the functions of a by-pass, it would require somewhat of a guess or conjecture, such as counsel for defendant sug-

gests? That is, in order to frame the hypothesis that there was or had been any by-pass device at these points?

Mr. Westall: Objected to. Let the witness state what he saw and what he observed and not enter the realm of guessing. What we want now is facts.

Mr. Blakeslee: We were adopting the guess route because counsel had suggested it, and, apparently, it fits the case.

A. There was no by-pass on either of these three wheels when I visited the plant. It would require a stretch of imagination and the addition of physical parts and a subtraction of other physical parts in order to secure a by-pass to any of these wheels.

Q. 505. I show you a bottle which apparently has liquid contents and is marked "Complainant's Exhibit Bottle of Kern River Water at Power Development Plant," and ask you if you have ever seen this bottle and its contents before?

A. Yes.

Q. 506. When and where and under what circumstances?

A. I saw Mr. J. F. Dearth fill this bottle with water from the reservoir or header supplying the wheels at the plant above referred to, on February 18, and know it to be a sample of water supplying these wheels and their hand-controlling apparatus and gate valves and pipelines and air-chambers.

Q. 507. From what source of supply did this water come?

A. It came from the water supplying the water

wheels and is an average sample of such water at the time I visited the plant. It primarily goes to the plant through a suitable tunnel and then down the pipe-line, being taken originally from the Kern River at a point a short distance above the plant on the river.

Q. 508. Have you made an optical examination of the water of this exhibit as to clarity, matter in suspension, visible contents, and the like?

A. I have.

Q. 509. In these respects please state from your experience how this water compares with the water supplying other hydro-electric power plants in the state of California with which you are familiar.

A. The water is particularly clear and well adapted to the operation of such plants and the controlling devices in connection therewith. It is entirely free from sand and cutting material of any kind and contains nothing but an extremely small quantity of decomposed vegetable matter in suspension which has absolutely no physical effect upon the operating parts of such plant.

Q. 510. Does the content of the stream water supplied to power stations in California vary from period to period of the year in amount, and in what manner.

A. It does. There being usually a heavier fall during the rainy period, some streams are more torrential in their nature than others, and evidence of torrential streams is usually found in the river beds, especially at those where the stream falls rapidly and at which points power plants are usually located. No unusual condition were observed by me, although I looked for these on the Kern River in or about the plant above testified to. The

sample of water which I have just examined and which I saw Mr. Dearth take from the water supplying the water wheels above testified to, was taken on the 18th day of February, during the winter season, and after a period of rainy weather in the mountains and adjacent territory, and should therefore be, if anything, a worse sample than would be obtained during the summer time and early winter period.

Q. 511. To your knowledge is there any variation discovered as being between the streams of the different parts of the state of California with respect to the content of silt and other comminuted matter, organic or inorganic?

Mr. Westall: Objected to as incompetent, immaterial and not proper rebuttal.

A. Yes; there is more organic material in the streams in the northern part of the state, on account of their being fed from territory having greater amounts of vegetation. There is more cutting materials in streams flowing from the Sierra Nevada Mountains in the central part of the state, as a rule, than with the streams of either the northern or southern part of the state. This applies particularly to streams coming from a watershed containing mining operations. I would therefore make the general statement that the streams of the central and northern part of the state are inferior to the streams below the Mother Lode district as regards the quantities of organic and inorganic suspended matter.

Q. 512. By Mr. Blakeslee: Within which general division of the streams as last made by you would that of the Kern River supplying this Power Development Company plant fall?

A. It would fall in the territory more favorable to this water being free from suspended organic and inorganic material, sand, silt, and so forth.

Q. 513. During your stay at this plant last week were any photographs taken by any person present to your knowledge?

A. Yes; I took a series of photographs at the plant on February 18, during the visit above testified to.

Q. 514. Can you produce prints of these photographs?

A. I can. (Witness produces nine mounted photographic prints which, upon the mounts of the same, are marked, respectively, "A" to "I", inclusive.)

Q. 515. I notice in certain of these photographs there appears the picture of a certain individual. Can you tell me who is so shown?

A. That is Mr. J. F. Dearth, the party who I previously testified accompanied me on the inspection of the plant.

Q. 516. Generally speaking, what do these photographs disclose?

A. They show parts of the apparatus in and about the Power Development Company station about which I have been testifying today.

Q. 517. And those photographs which apparently show objects and things outdoors were also taken of the respective objects at or near that plant?

A. All these pictures were taken on that day in and about the plant and refer specifically to the apparatus about which I have been testifying, with the exception of the one marked "A", which shows parts dug out of an

old scrap pile at the power plant and arranged with Mr. Dearth in the foreground to show certain parts which might have been inoperative and had been abandoned.

Q. 518 In Mr. Dearth's deposition reference is made to a number of objects or fragments of apparatus which he testified were arranged upon the pipe-line or penstock of this plant on that day, and which in his testimony he described, referring to these various objects or parts or fragments, by means of Roman numerals, figures one to ten, he also testifying that a photograph was taken of him and of these parts together on the same day, by yourself. Is that photograph among those?

A. That photograph is, and is marked "A".

Q. 519. You have referred in your previous testimony today to the hand-operated butterfly valve devices upon the feeder pipes supplying the wheels on this Power Development Company plant as you found it last week. Are these feeders shown in any of these photographs, and, if so, in which, and, if so how are the same designated in the photographs?

A. They are shown in photographs "B", "I", "D" and "E". In each of these pictures the worm gear mounted on the stem of the butterfly valve projecting from the supply-pipe is shown and has chalked thereon in photographs "B", "D" and "E", the figures 11, the operating stem carrying also the worm which meshes into this worm gear, as shown horizontally above the wheel and has mounted to the left thereof, the primary hand wheel. This horizontal stem extends also and is particularly well shown in photos "B" and "E" with gear connections through a vertical cast-iron pedestal

and a rotating shaft along the floor shown well in photo "B", by which rotating shaft this butterfly valve may be rotated through its worm gear and worm 11 from a more distant point nearer the switchboard..

Q. 520. You have also referred in your previous testimony given today about the Power Development Company plant, to a certain sealed or capped apparent outlet, or intended outlet, upon the feeder pipe or pipes of certain of the wheels of this plant as found by you last week. Will you please point these out in the photographs, if they there appear, using such indicating wording as you wish with a leading line to the part.

A. The photograph "D" clearly shows this sealed-up opening at the place where I have marked "Sealed Outlet." I have also marked "Sealed Outlet" at the corresponding point on the photograph "B", and on the photograph "E". These are sealed over by a cast-iron flange bolted thereto so as to completely and entirely cover the opening. No valve of any kind is used in connection with these sealed outlets. In exhibit "I" the connecting castings are shown without any form of operable valve or opening device therein, and I have marked this "Supporting Pipe" on the said photograph.

Q. 521. You have also referred in your testimony today to a certain outside relief valve and a certain outside reservoir connected with the pipe-line of the Power Development Company plant as you found it last week. If these are shown in any of the nine photographs before us, please mark the same respectively "Air Chamber" and "Outside Relief Valve."

A. The air-chamber I have marked "Air Chamber"

in photographs "F", "H" and "G". In each of these photographs the small connecting pipes going into the upperpart of the air-chamber for maintaining the air pressure therein to provide a suitable cushion for the inertia of the water upon a change of velocity of the water in the main pipe by the hand operation of the valve is shown, and I have marked this "Air Pipe." The relief valve which I have previously testified is actuated by hydraulic connections to a hand lever mounted near the switchboard in the interior of the power house is shown on photographs "H" and "F", and I mark on each of them "Hand Operated Relief Valve." The pipe connections for operating this relief valve on each of these photographs I have marked "Operating Pipes."

Q. 522. In the testimony of Mr. Dearth he referred to the sealing-up of a certain outlet opening for an intended by-pass device in the pipe-line of this plant. Does any one of these photographs indicate the position of such sealed-up openings? If so, please designate by indicating word "Sealed."

A. I have so marked on exhibits "D" and "E" the word "Sealed" at the point near the floor where any discharge connection from the outlet which is now sealed would otherwise have discharged. I might add that the conduits for the electric wiring from the generator also pass immediately under this outlet, and their general condition would indicate that they had been in place for a very long period of time, and their position is such that they could not pass through here with pipe connections from the otherwise sealed outlet.

Q. 523. You have also testified today with respect to a certain telescope used at this plant last week and positioned so as to make possible observation of the indicator position or condition at the gate in the forebay supplying the pipe-line or penstock leading to this plant. Do any of these photographs show such telescope? If so, please indicate, writing the word "Telescope" on the mounting of the photograph, with a leading line to the instrument.

A. It is clearly shown in photograph exhibit "C", and I have marked the word "Telescope" thereon. In this photograph also appears Mr. J. F. Dearth.

Q. 524. By whom were these negatives of these nine photographs taken by you developed?

A. I had them developed and printed by a professional photographer in town here.

Q. 525. And they were received by you directly from him?

A. Yes, sir; and I know them to be in all details correct photographic prints of the negatives taken by me as previously testified.

Mr. Blakeslee: Complainant offers in evidence the nine mounted photographic prints just described by the witness and ask that the same be marked respectively "Complainant's Exhibits Power Development Company Plant A, B, C, D, E, F, G, H and I."

(The said photographic prints so offered in evidence are marked respectively "Complainant's Exhibits Power Development Company Plant Photograph A, B, C, D, E, F, G, H and I.")

insert > Q. 526. By Mr. Blakeslee: Referring now to the butterfly valve devices which you have just testified

about as being provided at the Power Development Company plant for determining the flow of water in the several wheel units, can you compare the same with any valve device shown in the Lyndon patent in suit?

A. I can. The type of valve in use as hand control valves, there being one in each of the wheels at this Power Development Company plant controlled by hand, are the same type of valves as indicated in the Lyndon Patent No. 695,220 Fig. 1 as the type of by-pass valve therein disclosed. In Lyndon Patent Drawing Fig. 1 is disclosed in "Complainant's Exhibit A." Said valve appears in the said Fig. 1 as No. 48.

Q. 527. Please now compare or contrast this type of valve with the several types of valves found in "Complainant's Exhibit Wilson Sketch A, B, C, D and E," respectively, and, if it be possible, classify all of these types of valves as you may see fit.

Mr. Westall: Objected to as not proper rebuttal and being apparently an attempt to show that the butterfly valve which is in use has a resemblance to that of the Lyndon patent, which can be of no possible pertinence to the case.

A. The structure shown in Wilson sketches A, B, C, D and E, naturally group themselves into two generic classes. The early form of water gates consisted of a slide closing and opening, which slide acted upon its seat and ~~the valve disc, making the operation erratic and~~ ^{was retained on the seat by the valve}

1810 29 add "together with the title of the court and cause and the date upon which said exhibit was offered"

difficult and causing wear in the valve. This type of valve is shown in Wilson's Sketches "D" and "E" very

clearly. The operation of the disk across the seat, in order to vary the area of opening, is difficult and unsatisfactory, especially for governig purposes, in that the heavy friction element introduced by the water pressure against the sliding surfaces makes the governor move by jerks and prevents that sensitiveness and accuracy of control attainable with balanced forms of valves. The type of the valve shown as the by-pass valve in exhibit "C" is a differentiation of this sliding friction type and belongs generically to the same class, in that there are two surfaces in frictional contact at all times. The rotation of the by-pass valve in its chamber gives a metal-to-metal friction which causes jerks in the movement of the governor and prevents accurate and sensitive speed control or by-pass control, or both. The type of water gate shown in Wilson's Exhibit "C" are, on the other hand, sensitive and balanced or partially so, or may be readily balanced by external means, and as such are distinguished from the type of by-pass valve shown on this exhibit or sliding type of valve shown in "D" and "E". In Exhibit Wilson Sketch "B" both the water gates and the by-pass valve are of the balanced type and are sensitive to control of a governor and may, if designed of the proper proportions, be depended upon to operate sensitively and accurately in the governor control as distinguished from the earlier generic form of slide gates. The type of valves, both the water-gate and by-pass valve, shown in Sketch "A" are also of the balanced sensitive type. These two generic classes, that of the slide operating against a surface and heavily pressed against the said surface, whether it be a rotating form of valve as shown in Wilson's Sketch "C" or the flat

slide as shown in Exhibits "D" and "E", are inoperative for accurate governing control, whereas the generic type of valve as shown in Exhibits "A" and "B" is successful as a governing control valve or valves, in that there is no frictional resistance between the valve and its seat. The same applies to the type of valve disclosed by Lyndon in Fig. 1, "Complainant's Exhibit A," and shown thereon as No. 48.

Q. 527. Referring now to "Defendant's Exhibit Berry Blue-print No. 1," and to the valve marked No. 41 therein, does this fall within the category of either classification you have just made, and, if so, which, and for what reasons?

A. The valve marked "41" in both views of the Berry Blue-print No. 1 falls within the friction type of valve or first generic type above mentioned as being an inoperative type of valve in water wheel automatically governed machinery. This type of valve cannot possibly be depended upon in connection with automatic water-wheel control, as, if it is not inoperative in the first five minutes of its operation it will become so as soon as the surfaces have slid one over the other under the water pressure under which the valve is intended to operate, and ~~is~~ not used in any power plant, to my knowledge, for any such purpose.

Q. 528. And in using this type of valve like "41" just referred to, how does the pressure of the water intended to be controlled by the same effect such valve or act upon it?

A. The water pressure causes the valve to press heavily against its seat during all times of operation, and more especially so as it approaches its closed position.

Q. 529. What effect does that have upon the frictional conditions as between the valve and its case or seat?

A. The friction which is to be overcome in shifting the valve is proportional to the pressure of the water against the valve. It is not the case in the second generic class I have specified above, in that there is no friction between the valve and its seat at any time during its operation, regardless of the water pressure behind the valve.

Q. 530. And when, and only when, is the valve in contact with its seat in this other free moving class of valve?

A. In the free-moving or balanced class of valve the valve comes in contact with its seat only at the moment of complete closure and at no time does it rub against its seat in any sense of frictional contact.

Q. 531. In other words, the valve is only upon its seat when home, and not when moving toward home or away from home?

A. That is correct.

Mr. Westall: It is understood that in consenting to the taking of the deposition of Mr. Lyndon at this time the defendant does not waive any right he may have to cross-examine the witness W. W. Wilson.

Mr. Blakeslee: Due opportunity will be given the defendant to cross-examine the witness W. W. Wilson and the party Henry.

Los Angeles, Mar. 5, 1915, P. M.

LAMAR LYNDON, produced as a witness on behalf of complainant, being first duly sworn according to law, testified as follows, in rebuttal:

DIRECT EXAMINATION

By Mr. Blakeslee:

Q. 1. Please state your full name, age, residence and present occupation, Mr. Lyndon.

A. Lamar Lyndon; age, forty-three years; residence, New York; occupation, consulting engineer.

Q. 2. How long have you been engaged in your practice as consulting engineer?

A. Since 1900.

Q. 3. What if any academic and practical training did you have fitting you for such practice?

A. My technical education comprised four years in the University of Georgia, from which institution I graduated with the degree of Bachelor of Engineering; after which I went to the Stevens Institute of Technology to study mechanical engineering and from there I went to Cornell University to study electrical engineering, thus having spent nearly eight years in technical schools. After leaving Cornell I was manager of the Thomas Bailey Iron Works of Athens, Georgia, which position I left to take that of engineer for the Athens Gas & Electric Company. The plant which we operated was a water-power plant with a steam auxiliary. I left the Athens Gas & Electric Company to become associated with Her-rick & Burke, consulting engineers, in New York. In

1896 I went abroad for an American syndicate, and was gone for about two and a half years, during which time I was principally in Japan. I returned to America in the spring of 1898, the date of my arrival in New York being May 28, 1898. I came back to assume the duties of chief engineer of the American Trading Company, and continued with that company until 1900, after which I went to Baltimore on some special work and at the end of 1900 returned to New York and there entered into practice as consulting engineer, in which work I have since continuously been engaged.

Q. 4. Have you ever received any letters patent of the United States for any invention?

Mr. Westall: Objected to as incompetent, irrelevant, immaterial, unless it is limited to some invention within or alleged to be within the issues of this case.

A. Yes.

Q. 5. By Mr. Blakeslee: How many such?

Mr. Westall: Objected to for the same reasons as before stated.

A. My present memory is eighteen.

Q. 6. By Mr. Blakeslee: Can you state from your memory the subject of a number of the inventions covered by such Letters Patent or for which you obtained such Letters Patent?

Mr. Westall: The same objection.

A. One patent for an electrical thermostat, three patents on speed control of prime movers, five patents on train lighting systems, three patents on boosters for the regulation of storage battery charge and discharge, one patent on automatic end cell switches for storage bat-

teries, one patent on storage battery plates, two patents on means for charging storage batteries from alternating current, one patent on rheostats. That is about all I remember. These cover all that I can recall at present.

Q. 7. By Mr. Blakeslee: Can you mention any particular inventions for which you have received such patents relating to the regulation of speed of prime movers, referring particularly to the general nature of such inventions.

A. The three patents relating to speed control of prime movers cover specifically the speed control of water wheels. The first of these, which was the second invention that I ever patented, is the patent here in suit; and this was followed by two others, one of which related to certain changes in detail of the first one mentioned, and the other covers an entirely different means of speed control from that disclosed in the first named patent.

Q. 8. You have referred to the invention disclosed and patented in and by the second patent issued to you, namely the patent here in suit. Can you give approximately a date corresponding to the inception of your conception of the invention of that patent?

Mr. Westall: Objected to for the reason that it has not yet appeared that the witness knows what patent is in suit.

A. It is impossible for me to say at what date the conception of this invention came to me. I know that the principle of using a variable voltage generator for supplying current to an electromagnet as a means of control, came to me prior to my return to America, and, therefore, prior to the spring of 1898. Also, the pro-

vision for the returning device followed very closely on the first conception of the use of a variable voltage dynamo with a solenoid supplied from it, as a speed-control mechanism. The invention, however, was not completed until the month of June, 1898. The particular day or date in that month I do not remember, and I am only able to fix the month by certain collateral facts. This final portion of the invention was the application of the by-pass valve moving inversely to the motion of the water-wheel gate, actuated by the governing mechanism, and, after governing was completed, arranged to be returned slowly to its normal position. I have already made an affidavit in which I have set forth, approximately, the time and the manner in which this portion of the invention was made. All the other portions were made prior to that time, and as far as I am now able to recall, the original inception of the variable voltage principle for speed control was at least six or eight months prior to June, 1898.

Q. 9. By Mr. Blakeslee: And what month of what year was it that this invention, as disclosed by said patent sued on in this case, was and had been completely conceived of by you?

A. The month of June, 1898.

Q. 10. I show you "Complainant's Exhibit A," and ask you if you know anything about it, and, if so, state what.

A. This is a copy of Letters Patent No. 695,220 granted to me and covering the essential features of water-wheel governors which I had invented and which invention was completed prior to July, 1898.

Q. 11. What if any connection is there between that

Letters Patent and the Letters Patent you have mentioned as being that sued on herein?

A. I understand that the patent sued on in this case is this same patent, No. 695,220.

Q. 12. Have you had any actual experience in connection with the art of hydro-electric power generation?

A. Yes; both in this country and abroad, and my work for the past few years has been almost entirely in hydro-electric development.

Q. 13. Have you been more recently connected with any hydro-electric power project? If so, please describe it and locate it.

A. I have just finished the work of construction of a hydro-electric plant on the Colorado River at Austin, Texas, acting as consulting and designing engineer on the work. This construction has been in progress for nearly four years and the dam, and artificial body of water which it forms, are among the largest in the world. The head obtained by the dam is used for power purposes, and the power plant comprises a full equipment of electric generators driven by water wheels, and the speed is controlled by water-wheel governors with the usual accessory electrical and mechanical apparatus.

Q. 14. What type of water-wheel governors are used in that plant?

A. Lombard oil-pressure-actuated governors.

Q. 15. Do you know who manufactures and supplies to the market this Lombard governor, and, if so, state.

A. The Lombard Governor Company of Ashland, Massachusetts.

Q. 16. Please identify several of the interests which you have advised or with whom you have been associ-

ated as consulting engineer during your experience in that practice.

A. Beginning with the Athens Gas & Electric Company and the construction of the water-power plant there, with the water-power plant in Japan, near Lake Biwa, the name of which I do not now remember; with several projected plants among which were that at Gainesville, Georgia, on the Chattahoochee River, one below Mechanicsville, Alabama, on the same river, and one below Calhoun Falls, South Carolina, on the Savannah River, and a water-power plant which I constructed at Boonton, New Jersey, on the Rockaway River; investigation of water-power plant at Bristol, Tennessee; one at Clifton, Ohio; one near Columbia, South Carolina, on the Saluda River, and my last connection was with the development at Austin, Texas, about which I have previously testified. The others I do not remember; but I think that is sufficient.

Q. 17. In your engineering practice have you been associated with other engineers? If so, please identify them with respect to their work and position in the engineering field.

A. I worked for a while with Elmer A. Sperry as an associate in the development of the Sperry-Lyndon system of train lighting, which was sold to the National Battery Company, now the United States Heating & Lighting Company of Niagara Falls, and I was a partner in the firm of Duncan & Lyndon, which firm was composed of Dr. Louis Duncan, past president of the American Institute of Electrical Engineers, and myself. As far as I now recall, these were the only two associations which I have had with other engineers. The position of Mr.

Elmer A. Sperry is well known in the electrical art. He was one of the pioneers in arc lighting, being the designer of the old National Electric Company of Chicago. He also developed the Sperry electric railroad system, and the Sperry electric brake, and the patents on electric railway devices were finally sold to the General Electric Company for a sum which I have been informed by Mr. Sperry was \$219,000. Mr. Sperry has, since my association with him, been active in the development of the gyroscope for the steadying of ships, and, as I believe, acquired considerable reputation both in America and abroad in this line of effort. Dr. Louis Duncan is considered by European scientists and engineers to be the foremost man in America in his line, and he has had for many years a reputation of the very highest character. For twelve years he was Professor of Electrical Engineering in Johns Hopkins, and for three years was Professor of Electrical Engineering at the Massachusetts Institute of Technology. He is past president of the American Institute of Electrical Engineers and a member of the Mathematical Society of France. He developed the underground trolley and made traction without the use of overhead wires possible by his development in this branch of the art, and was the first engineer to reduce heavy electric traction to commercial practice on the Baltimore & Ohio Railway in the tunnels at Baltimore.

Q. 18. After the completion of your conception of the invention disclosed and patented in and by your patent No. 695,220, as per "Complainant's Exhibit A," which is a copy thereof, sometime prior to the 1st of July,

1898, what did you next do in and about or concerning that invention in any respect?

A. I attempted to interest manufacturers in it with the intention of inducing them to make and sell the water-wheel governor which I had invented.

Q. 19. Prior to such attempts did you at any time disclose this invention to any other person or persons?

A. Yes.

Q. 20. When did you make such first disclosure, and to whom, and state the circumstances.

A. The first disclosure of the complete invention was made to Henry C. Meyer, Jr., of New York, in the City of New York, and sometime during the month of June, 1898. Very soon thereafter, and during the year 1898 but at times which I cannot now fix except approximately, it was disclosed to a number of other people who were engineers that the company which I was then associated with was doing business with, or who were my personal friends.

Q. 21. That goes a little beyond the question, and I will ask you to state more fully the circumstances surrounding this first disclosure to Mr. Meyer, fixing the time as accurately as you can, and the place, and stating what transpired on the occasion of this disclosure to Mr. Meyer.

A. As I have stated in an affidavit which I made concerning this matter, Mr. Meyer was a classmate of mine in the class of 1892 at the Stevens Institute of Technology, and at the time I returned to America was one of the editorial staff of the *Engineering Record* which journal was then owned by his father, Henry C. Meyer, Sr. The offices of the *Engineering Record* were in the

Woodbridge Building, at 100 Williams Street. The offices of the American Trading Company, with which company I was connected, were in the same building. The same friendly and cordial relationship which had existed between Mr. Meyer and myself during our student days at the Stevens Institute, were still sustained when I returned to America. In fact, we had kept up a fairly active correspondence during the entire time of my absence abroad. It was our custom, as nearly as our business arrangements would permit, to take lunch together every day, usually at the lunchroom called the "Westchester," which was diagonally across the street from the Woodbridge Building on Williams street. One day I outlined to Mr. Meyer the idea which I had with regard to a proper method of speed control of water wheels, beginning with the idea of a controlling dynamo in which the voltage would vary at a more rapid rate than the speed variation of the dynamo, a solenoid, the pull on the plunger of which would vary more rapidly than the electro-motive force impressed at the terminals of its windings, means of preventing governor over-running, by the application of an additional force to that set up by the magnetic force of the solenoid, and the application of which additional force would always be in a direction opposite to the tendency of motion of the solenoid, and means for preventing the governor from overrunning—that is, going past the proper position of gate-opening—which means comprised simply limit stops which would open contacts in the electrical circuits through which the electro-magnetic actuating parts of the governor were energized. These features were discussed between us, and I remember pointing out

to Mr. Meyer that one of the objects which I desired to obtain was a rapid movement of the water-wheel gate. Mr. Meyer stated that an excessively rapid movement would not produce the conditions of good governing, which I had hoped to obtain, by reason of the inertia of the column of water and the stored energy in it. It was at that time that the idea of the by-pass valve arranged to move in a direction opposite to the direction of motion of the main valve occurred to me, and I then made a rough sketch of the device, describing it, with the assistance of this sketch, to Mr. Meyer. It was on that date, and at that specific time, that the invention as disclosed in the patent here in suit was completed, so far as my conception of it is concerned.

Q. 22. How much of such conceived and invented matter did you disclose to Mr. Meyer, Jr., at that time? That is, the matter which you have recited in your last answer.

A. I disclosed to him the variable voltage methods by which electrical contacts would be made or broken, depending on the speed of a small governor generator.

Q. 23. (Interrupting) Pardon me. I think I can shorten your answer by putting the question this way, the answer not being responsive to the question, and I therefore break in upon the answer: Please state what part of such matter you disclosed, whether in toto or only part, and referring to the matter of your answer referred to last.

Mr. Westall: I object to counsel interrupting the answer of the witness to the question, which answer was clearly responsive, and by which interruption he evi-

dently expects to forestall something that is not entirely favorable.

Mr. Blakeslee: The propriety of the proceeding speaks for itself. The answer was not responsive.

A. It is difficult to say, absolutely, that I disclosed to Mr. Meyer all of the details of this invention. The salient features of voltage control, and method of preventing overrunning, and the by-pass valves, were disclosed to him. I do not remember whether or not I disclosed the method of preventing over-travel of the governor. By this I mean an attempt of the governor to move the gates after they had been fully opened or fully closed, as far as it was possible for them to go. The reason why it is probable that some of the detailed methods by which I expected to accomplish certain of the results were not gone into at that specific time with Mr. Meyer, is, that many of the details of any mechanism are sufficiently obvious to a trained engineer to make it needless to discuss them. For instance, the fact that the operation of the governor in any one direction must cease after the gates are fully moved in that direction as far as they will go, is an obvious mechanical condition; and in discussing important and new features and combinations, it is probable that such a detail as this might not have been mentioned, although I cannot say definitely that I did omit even to mention this to Mr. Meyer. My memory at this time is definite only on the points that I disclosed to him, the salient features which I have already mentioned as having sketched out and discussed with him.

Q. 24. And in your disclosure to Mr. Meyer at that

time what was to be the nature and arrangement and province of the by-pass valve you have referred to?

A. I remember a phrase which I happened to use at the time, and I remember it because I have used it so often since in explaining the action of the governor, as it seemed to me to most concisely describe one of the most important features. That was, that I stated that I had transferred the time element necessary for acceleration and deceleration of the column of water, from the water-wheel gate to the by-pass valve.

Q. 25. What would this transferring of the time element to the by-pass valve require as to the arrangement and movement of the by-pass valve?

A. It would require that in closing the water-wheel gates rapidly, that is, more rapidly than the column of water could be retarded without setting up comparatively high pressures in the penstock and turbine casing, the by-pass valve would have to open, and open at some rate which would be related to the rate of closing of the main gate. After the governing action would be completed this would leave the by-pass valve open and water flowing through it, and provision would have to be made whereby the by-pass valve would then return to its normal position, and in returning, its rate of motion would have to be substantially slow enough to allow the column of water leading to the turbine casing and to the by-pass valve to diminish gradually in velocity and at a sufficiently gradual rate of diminution in velocity, as to prevent the production of any comparatively high or excessive pressures in the penstock and wheel case.

Q. 26. And how, similarly, with respect to the by-

pass in connection with moving the water gate in an opening direction?

A. In the case where an ample supply of water is available, and by that I mean a sufficient amount of water not only to supply the power requirements of the plant which is actuated by the water supply, but also a sufficient quantity of water in addition to allow the continuous efflux of a certain proportion of the whole amount, the preferred normal position of the by-pass valve would be in a half-open and half-closed position.

Q. 27. And that is the position to which the by-pass valve would return, subsequent to a completed governing action?

A. When set for that position, it would.

Q. 28. And how would the normal position of the by-pass valve be predetermined in any particular installation?

A. At periods when ample supply of water would be available the normal position for which it would be set would be half-open and half-closed. At periods when the water supply would be low the by-pass valve would be set normally closed, and then could move only to open the gate and relieve internal pressures which might be set up, due to rapid closure of the water-wheel gates. This would be a general statement of conditions. Of course, these general conditions are subject to modifications for any specific conditions of plant. For instance in the case of a pipe-line in which the slope was very small, the rate of acceleration of the column of water in case the water-wheel gates were quickly opened would be slow, in which case it would be more desirable to have

a continuous flow through the by-pass valve whenever a sufficient amount of water would be available for this purpose, than when the slope of the penstock would be high. For a rapid penstock slope or for the case of maximum slope, namely, a vertical penstock, the rate of acceleration of the water is, of course, more rapid for a given mass of water and length of penstock than when the slope is small. In that case there is scarcely any advantage to be derived from having the by-pass valve kept partly open, even when an ample supply of water is available, for the reason that the rate of acceleration of the column of water is sufficiently great to keep pace with the rate of opening of the water-wheel gates. On the other hand, in the case of a penstock having a rapid slope, or being set vertically, it is imperative to have some means for relieving the pressures set up, due to sudden closing of the water-wheel gates. And from these considerations it follows that under the conditions of rapid slope of penstock, the normal condition for which the by-pass gate would be set, would be the closed position. All of these considerations were duly entered into between myself and the patent attorneys, Messrs. Knight Brothers; and also, they were given due consideration when this matter was first brought before Mr. Thorburn Reid, acting for the American Impulse Wheel Company, and later with Mr. Thomas Shipley, general manager of the York Manufacturing Company.

Q. 29. In what connection did you bring up these matters which you have mentioned with Knight Brothers, the patent attorneys you have mentioned?

A. In connection with the fundamental character-

istics of an invention that I desired then to cover in drawing patent specifications and claims.

Q. 30. And what patent specifications and claims do you refer to?

A. For the patent in suit in this case.

Q. 31. You have referred to a returning device for preventing the governor from overrunning, and you have also referred to the cut-out means or stop means for preventing the governor mechanism from traveling too far, so as to jam the water-wheel gates, for instance. Are we to understand that these features were the same or different in your invention as disclosed to Mr. Meyer at the time you have stated, and later disclosed in your patent, namely, the patent in suit.

A. These features are in no wise different from those which I had in mind when I disclosed this entire invention to Mr. Meyer.

Q. 32. What I mean is, were these features identical each with respect to the other? Or were they different each from the other? That is, was there one such, or were there two such features?

A. They were totally different, if I understand your question correctly. The device preventing overrunning of the governor was self-contained and complete in itself and independent of any device for preventing over traveling of the governor.

Q. 33. And the over-travel of the governor was to be prevented for the purpose of eliminating any possibility of the water-gate jamming?

A. That is correct. The means for preventing over-travel was possibly a later addition to the original invention. That I do not now recall. I do know that even

at the present time on commercial water-wheel governors it is necessary in plants to add some means for preventing over-travel even after the governor is purchased and installed, which is not an intrinsic portion furnished by the governor builders.

Q. 34. Those are in the nature of stop means or limit means?

A. Yes.

Q. 35. Do you know who is the owner at the present time of the Letters Patent in suit as per "Complainant's Exhibit A?"

A. I understand the owner to be Mr. George J Henry, Jr. At any rate, he purchased this patent and came in possession of it at one time.

Q. 36. Do you mean the complainant in this case?

A. Yes, sir.

Q. 37. From whom did he purchase this patent, if you know.

A. He purchased it direct from me.

Q. 38. Have you any interest, whatsoever, in that patent at the present time?

A. None at all. The transaction was a straight-out purchase, without any obligation on either side as to the future, in any way.

Q. 39. Have you any contingent interest of any nature in this present suit, or any suit to be brought under this patent?

A. None whatever.

Q. 40. Are you under any binding legal obligation to testify on behalf of complainant in this action?

Mr. Westall: I object to the question as calling for

a legal conclusion and a knowledge of law which it has not been shown the witness is qualified to give.

A. No.

Q. 41. By Mr. Blakeslee: Now, how specifically can you state the time at which this disclosure to Mr. Meyer took place in the Westchester restaurant in the year 1898, at which time you disclosed the invention of the patent in suit, as you have recited, to Mr. Meyer?

A. I can only fix it as prior to the time that I left New York in July, 1898, to go to Athens, Georgia.

Q. 42. What part of the month of July was it when you went to Athens, Georgia?

A. I believe it must have been after the middle of the month.

Q. 43. Then this disclosure took place, if I am correct, between the 1st of June and the last of July, 1898. Is that correct?

A. Yes.

Q. 44. And at that time did you in any other manner than verbally disclose or assist disclosures of your invention to Mr. Meyer?

A. Yes. I made a sketch at the time that I first made this disclosure to him at the time when we were at lunch together at the Westchester restaurant, and which time I fix by reason of several collateral circumstances to be during the month of June, 1898.

Q. 45. Have you any of the sketches made at either of these times?

A. No. The first sketch, I remember, was made on the back of the restaurant bill-of-fare, possibly reinforced by other sketches on the tablecloth.

Q. 46. Do you know what has become of any of these

sketches, and, particularly, those that you made at the time of your full disclosure prior to the last of July, 1898, at the Westchester restaurant?

A. No. These sketches were all roughly made at the moment, and made for the purpose of explaining the particular characteristics of the invention, and at that time I had no knowledge of the importance of retaining the original sketches which might be made of an invention.

Q. 47. Can you, generally, reproduce these last sketches last mentioned at this time?

A. I could, but I would not at this time remember whether they looked like the sketches which I made fifteen years ago to show Mr. Meyer how the proposed device would operate.

Q. 48. When you say "fifteen years ago," do you mean to be specific or general?

A. Simply general as indicative of a considerable lapse of time since the original sketches were made. As a matter of fact, it is nearer seventeen years ago than fifteen.

Q. 49. Now, did these sketches made at that time for Mr. Meyer go into minutes¹⁰² and specific details, or did they indicate the several elements in kind, or how fully did they illustrate and assist the disclosure made verbally by you to Mr. Meyer?

A. They illustrated only the salient principles of the device and the general methods by which the object which I sought to attain would be obtained in an operating machine.

Q. 50. And because of Mr. Meyer's engineering and technical ability, was it necessary to go into details as to

the construction of by-passes, dynamos, solenoids, etc. in such sketch disclosures?

A. No. As I have stated, Mr. Meyer was a graduate then of six years' standing, from the Stevens Institute of Technology, and was one of the editorial staff of a technical journal of high order, and, necessarily, possessed of mental training and capacity to understand that if a mechanical or electrical principle were shown him there might be a multitude of ways by which the principle might be made operative for a useful purpose.

Q. 51. Was Mr. Meyer's mentality of a nature which would readily receive and retain impressions or disclosures of the nature you have stated you gave him?

Mr. Westall: Objected to as calling for opinion evidence upon a matter of psychology, rather than a matter of fact, in the issues of this case.

A. My knowledge of Mr. Meyer and my association with him, extending over a number of years, enables me to give a very definite reply. His mentality is such that if he once receives an impression it is, as a general thing, permanent with him. Furthermore, in his capacity as one of the editorial staff of *The Engineering Record*, he had had a number of years' experience in receiving and setting down technical impressions. These factors, of course, were reinforced by the training which he received in Stevens' Institute of Technology, and he has since shown himself by engineering work he has done to be a man having a high order of mentality. He has been for some years consulting engineer for all of the steamship lines owned by the American

Line coming into New York Harbor. He is the engineer selected by the United States Government to rebuild and rehabilitate the entire power plant and heating and ventilation system of the U. S. Military Academy at West Point, and is one of the consulting engineers for the office of J. P. Morgan & Company of New York.

Q. 52. By Mr. Blakeslee: Will you please, before appearing to further testify here tomorrow morning, reproduce as closely as you can the sketches which you made on the occasion of your full disclosure as testified of the invention of the patent in suit to Mr. Meyer at the Westchester restaurant in 1898, which sketches you made in connection with your said disclosures of the invention, and produce the same at this place.

After your recited disclosures in respect to this invention to Mr. Meyer, did you disclose the invention to any other person prior to taking steps looking to the manufacture of the governor mechanism? And, if so, please state to whom next in order, when, where and the surrounding circumstances.

A. I am not able to say who was the next person after Mr. Meyer to whom I revealed this invention. I saw Mr. E. A. Merrill frequently, as we had certain business negotiations at that time that required us to meet very frequently, and I at one time and at one of those meetings disclosed the invention to him. I am not able to say, however, whether this disclosure to Mr. Merrill was prior to or subsequent to the disclosure to Mr. Thorburn Reid. I used to see Mr. Reid very frequently, and his assistant, Mr. Richard R. Bryan, and to both of these

gentlemen I not only disclosed the invention, but discussed with them details of the best methods of machine design and materials to use in reducing this invention to practice.

Q. 53. Where was your home at this time, namely, in the summer of 1898?

A. My home was in Athens, Georgia. That is to say, that is the place that had been my home until my departure for Japan,

Q. 54. Did you at any time return to your home in Athens, Georgia, after returning from Japan in the spring of 1898?

A. Yes. I went to Athens sometime during the month of July, 1898.

Q. 55. And how long were you there?

A. I don't remember, but I think it was three or four weeks or possibly longer.

Q. 56. During your stay at your home in Athens, Georgia, at that time, did you disclose the invention which you disclosed to Mr. Meyer previously, or any part of that invention, to any person?

A. Yes.

Q. 57. Whom?

A. To my brother, Mr. Edward Lyndon, who at that time was a student in the University of Georgia.

Q. 58. Can you go farther and state any circumstances surrounding or pertaining to such disclosure to your brother at that time?

A. It had been about two years and a half, or possibly more, since I had seen my brother, and at the time that I saw him he was then, if I remember rightly, in

the Junior class at the University of Georgia, and was not only then very much interested in the engineering subjects that he was studying but for years prior to his entrance into the University had been interested in mechanical and electrical principles and devices. In addition to that, our family owned certain works that used machinery, and he had been accustomed to machinery and mechanical devices from his early boyhood, so that he was mentally equipped to receive this disclosure and to appreciate all of the factors which pertained to this device, and was at a receptive age when such a disclosure would make an impression on him. Furthermore, my home-coming, after so long a period away and having been such a great distance from America, was another circumstance which would fix the time of this disclosure, both in his mind and in mine. I am under the impression that I also disclosed this at the time to others in Athens, and I think to the then Professor of Engineering in the University of Georgia. But of that I am not now sure.

Q. 59. How fully did you disclose this invention under discussion, to your brother while at home on the occasion of this visit, with relation to the fullness of disclosure which you have received as having made to Mr. Meyer shortly previously at the Westchester restaurant in New York?

A. I know that I disclosed to my brother all of the parts and functions that I did to Mr. Meyer, and I am under the impression that at that time I disclosed to him also the limit stop-device in addition to the other features of the invention.

Q. 60. Did you make any sketches in connection with your disclosure to your brother at that time?

A. I do not remember any sketches, but I know that I must have made them as there was no other way in which I could have disclosed it to him.

Q. 61. Have you any such sketches in your possession or under your control at this time?

A. No; I have not. In fact, many of the working sketches and computations which I later made in connection with the design of the apparatus I have not in my possession.

Q. 62. You have referred to your return to New York on May 28, 1898. Do you remember the steamer upon which you returned and the port from which you sailed to New York on that steamer?

Mr. Westall: Objected to as immaterial.

A. Yes.

Q. 63. By Mr. Blakeslee: What steamer was it?

A. We sailed from Liverpool on the Teutonic of the White Star Line.

Q. 64. And have you taken any steps recently to determine by any record or memorandum the date of the arrival of that steamer at New York? And, if so, in what manner?

A. There are certain—not specific records—but matters which I have been able to refer to which fixes the arrival as the late afternoon of May 28, 1898.

Q. 65. What would you fix as the approximate time of your return to New York from your home in Athens, Georgia, in the summer of 1898, if you so returned.

A. During the month of August. At what part of

the month I cannot say, except inferentially. I would say it was sometime between the 10th and the 20th of the month.

Q. 66. And that was subsequent to your disclosure of the invention to your brother?

A. Yes.

Q. 67. Now, with reference to your return to New York City in August, 1898, when was it that you discussed the invention under consideration with Mr. Thorburn Reid?

A. My present memory is that I discussed the matter with Mr. Reid to some extent before I left New York, and that it was after I returned to New York in the latter part of the summer of 1898 that I took up the subject of the manufacture of water-wheel governors, under my invention, with Mr. Reid.

Q. 68. With what, if any, interests was Mr. Reid associated at this time?

A. He was consulting engineer of the American Impulse Wheel Company of New York. Their office was at 120 Liberty Street.

Q. 69. And was it in connection with Mr. Reid's association with this company that you discussed this invention with him?

A. My first disclosure to him was in the nature of simply a conversation, without any business expectations—merely a discussion between engineers of a proposed new method of accomplishing a desired and, up to that time, unaccomplished object. Later I brought it to the attention of the American Impulse Wheel Company, through Mr. Campbell, whose initials I do not now re-

member, and who was either president or vice-president of the American Impulse Wheel Company, and he naturally referred the matter to Mr. Reid who was then consulting engineer of this company.

Q. 70. Did Mr. Reid render any conclusions or report with respect to this invention so submitted to his company and to him?

A. I have no means of knowing what Mr. Reid might have reported to the American Impulse Wheel Company.

Q. 71. Did Mr. Reid state to you any findings with respect to the merits of your invention?

A. Yes. He told me that in his opinion the invention was a good one, and, a well-designed machine which would incorporate in it all the factors and produce the various results outlined, would be a desirable one, and, probably, the manufacture of it would be a good commercial venture. It was about this time, however, that the relations between Mr. Reid and the American Impulse Wheel Company ceased, and Mr. Campbell decided that he would not go any further into the manufacture of hydraulic machinery of any character. So that these negotiations came to an end, and I think, somewhere about December, 1898.

Q. 72. Referring to the first discussions, or earlier discussions which you had of such invention with Mr. Reid, did they take place subsequent to or prior to your disclosure of the invention at the Westchester restaurant to Mr. Meyer, before the end of July, 1898?

A. They were subsequent to the disclosure to Mr. Meyer.

Q. 73. And how did such discussions with Mr. Reid

compare as to the general field of disclosure of such invention with the disclosure made at the time last mentioned to Mr. Meyer?

A. It would be difficult to say. I made a full disclosure to Mr. Meyer of the fundamental characteristics of this device. It is probable that in discussing the matter with Mr. Reid the commercial form of machine took more definite shape, and that the possibilities of different characters of materials were more fully discussed. I recall a discussion—not with Mr. Reid, but with Mr. Reid's assistant, Mr. Bryan,—about the question of material for the friction surfaces and the possibility that I then feared that if made of metal, incidental or accidental lubrication of these surfaces might so change the co-efficient of friction as to be injurious to the operation of the machine, and, therefore, I considered that some other form of friction surface might be desirable, and Mr. Bryan suggested the use of wood with the end grain exposed to contact with metallic discs.

Q. 74. In connection with your recited disclosure or disclosures of your invention under discussion to the American Impulse Wheel Company, and its Mr. Campbell and Mr. Reid and Mr. Bryan, did you or did you not submit any sketches or drawings disclosing said invention?

A. I made sketches, but at the time did not submit any drawings, as it was my view that the actual shop drawings and the details of design would be worked out jointly by Mr. Reid and myself. At the time of this disclosure to Mr. Reid, a Mr. Van Dyke was general manager of the American Impulse Wheel Company, and he

also knew of this invention. Mr. Van Dyke has been in Europe, and he returned not long ago.

Q. 75. How shortly after your said return from Athens, Georgia, did you take up this matter of your said invention with the American Impulse Wheel Company?

A. It must have been very soon after my return, but just when, I now have no means of knowing.

Q. 76. Can you place a limit upon the time in weeks?

A. I should have said it was certainly within three or four weeks.

Q. 77. And that would be from the middle part of August, 1898?

A. It was sometime certainly not later than the month of September, 1898.

Q. 78. Now, as to your discussions of the invention with Mr. Merrill, to whom you have referred, about when did they take place, if you can remember.

A. I should say that they were some time between the first of September and the end of 1898. That is as clearly as I at the present time remember when that disclosure took place. I know that at the time of my arrival in America there were business relations between the McIntosh & Seymour Company, which company Mr. Merrill represented in New York, and the American Trading Company, of which company I was chief engineer, with reference to some large vertical engines that would be built for Japan and be shipped there, and I know that I met Mr. Merrill very soon after my return to America and I feel certain, without being able in any way to prove the certainty thereof, that it was prior to my going to Athens, Georgia.

Q. 79. Have you in your possession or under your control any of the drawings or sketches submitted by you in connection with the disclosure of your invention to the American Impulse Wheel Company and the persons whom you have spoken of as being connected therewith?

A. No, none.

Q. 80. Do you remember the name of any other person to whom you disclosed this invention at or about the times of the disclosure to Messrs. Reid, Merrill, Meyer and others?

A. I have already mentioned Mr. Van Dyke of the American Impulse Wheel Company and Mr. Campbell, and I also disclosed the invention to Mr. Aubrey H. Martin of New York, and to Mr. Frank A. Wunder who was then manager of the New York and export offices of the Ft. Wayne Electric Company, and also to other persons whose names now escape me.

Q. 81. About when was it that you made such disclosure to Mr. Martin?

A. I am not sure. It was certainly in the year 1898, but at what time during the year I cannot now be sure. I know that very shortly after my return I met Mr. Martin again. I know that it was prior to November, for these reasons: On my return to America I rented a house in New York on Seventieth Street, the number of which I do not now remember, but it was one door removed from West End Avenue. That house I had temporarily, until sometime in October. Mr. Martin was at that house several times, and, therefore, my meeting with him and my disclosure to him was prior to November, 1898.

Q. 82. How fully did you go into the matter of this invention with Mr. Martin in these disclosures?

A. Well, I disclosed the nature of the invention to him. It was a matter which interested me very greatly, and all the features of it appeared to me to be important and new in the art, and whenever I came in contact with an engineer who understood these matters I took the opportunity to discuss it with him in all its details. And without being able to say specifically what I said to Mr. Martin, I know that I revealed it to him fully.

Q. 83. And was your first disclosure to Mr. Martin of the invention under discussion prior to or subsequent to your disclosure to Mr. Meyer at the Westchester restaurant before the end of July, 1898?

A. It was subsequent to my disclosure to Mr. Meyer.

Q. 84. Did you make any sketches of the invention under discussion to Mr. Martin at any time when you disclosed the invention to him?

A. Without remembering about the sketches, I know that I must have made them for him, because there was no other way in which I could have made clear to him the very features that I wanted him to understand and that I wanted to discuss with him.

Q. 85. Have you any such sketches in your possession or under your control at the present time?

A. No; I have not.

Q. 86. What was the final decision of the American Impulse Wheel Company with respect to exploiting your invention?

A. That they would not attempt to produce and market it, for the reason that they intended to also give

up the manufacture of the impulse wheel which they were then making.

Q. 87. And for that reason would not go into the governor field?

A. Would not go into the governor field nor the manufacture of any other hydraulic machine.

Q. 88. After this negotiation with the American Impulse Wheel Company, did you take any further steps looking to the exploitation or manufacture of your said invention? And, if so, when next, and what are the facts regarding such steps?

A. The next effort I made to have a company undertake to manufacture and sell this device was when I approached the New York and the Export representative of the York Manufacturing Company of York, Pennsylvania. This representative was Mr. David S. Hays.

Q. 89. How did you get in touch with the York Manufacturing Company?

A. The American Trading Company was doing certain export business with the York Company through Mr. Hays, and at that time the York Company was manufacturing almost exclusively ice-making and refrigerating machinery. Mr. Hays told me that it was the intention of the York Manufacturing Company to make a line of turbine water wheels, and to that end had retained the services of Mr. McCormick, who had designed a number of turbine water wheels for other manufacturers in that general section of Pennsylvania. I suggested to Mr. Hays that if the York Company intended to engage in the manufacture of hydraulic machinery,

that it would be desirable for it to manufacture a water-wheel governor, and further suggested that his company manufacture a governor in accordance with my invention and on a royalty basis. After several interviews, Mr. Hays concluded that this suggestion was a good one and, in accordance with this conclusion, placed the matter before his principals at York. Later, Mr. Thomas Shipley, the general manager of the York Manufacturing Company, came to New York, and I had an interview with him concerning this same subject. After some negotiations they undertook to make shop designs for a governor which would be and act in accordance with my invention, and, I believe, began work on these designs very shortly after we had reached an agreement. The work in the draughting room of the York Company, in the laying out of ~~machinery~~^{work} of the kind that the company was then manufacturing, became so great that they were forced to put aside the design of this new machine for a while, and the work of design therefore dragged over a considerable period of time; but how long, I am not able from memory to say, but I believe the records of the York Manufacturing Company as shown in the copies of letters to me, which I have, will indicate over how long a time the production of these drawings was protracted.

Q. 90. Approximately when was it that you took up this matter with the York Manufacturing Company through Mr. Hays?

A. I do not now remember, but I believe it was early in the year 1899.

Q. 91. About what month?

A. I could hardly say now, but I believe it to have been in January or February.

Q. 92. It was certainly early in the year?

A. It was prior to the summertime, but I do not now remember. It might have been in the early spring.

Q. 93. How soon thereafter did you take up the matter with this company through Mr. Shipley?

A. That I do not remember, but I think that is indicated by the letters which I have just referred to.

Q. 94. Can you produce the copies of letters which you have just referred to as passing between yourself and the York Manufacturing Company in connection with your said invention in 1899?

A. I can produce copies of letters which went from me to the York Manufacturing Company, but not any of the originals of ~~my~~^{any} letters from the York Manufacturing Company to me.

Q. 95. And for what reason?

A. I have not kept any of the records, because when I moved my office to No. 2 Rector Street, I destroyed a number of boxes of old correspondence and sketches, relating not only to this device but to many other things, not having any idea at that time that they would ever possess any future value, and I desired to get rid of all the papers for which I had no apparent use. Later, when the partnership between Dr. Louis Duncan and myself was formed and I moved from No. 2 Rector Street to No. 56 Pine Street, I made a similar cleaning-out of all papers, sketches and documents, the usefulness of which I then considered had passed, and some three years after that when the partnership between

Dr. Duncan and myself was dissolved and I moved to my present offices at No. 60 Broadway, I went through the process of again clearing out all of the old papers and sketches that I thought would be of no further use, so that any of the old sketches that I may have that relate to this governor are very few, and my possession of them at this time is accidental. There are a few of the original sketches which I made for the York Manufacturing Company to guide their draughtsmen that are still in existence, and the only reason why these happen to be now available is that they were overlooked in the clearing-out process which I have just mentioned.

Mr. Blakeslee: Let it be noted that the witness produces a number of purported copies of letters passing between Mr. Thomas Shipley and Mr. David S. Hays and the York Manufacturing Company, as represented by these gentlemen, and between the York Manufacturing Company and its representatives or officers and Mr. Lyndon, to which is attached what purports to be an affidavit by one Thomas Shipley, which we will ask the Examiner to mark as "York Manufacturing Company Correspondence and Affidavit of Thomas Shipley, for Identification."

(The said documents are so marked.)

Q. 96. By Mr. Blakeslee: Can you likewise produce the early sketches which you have referred to as having been furnished by you to the York Manufacturing Company?

A. (The witness produces a group of sketches, to which is attached what purports to be an affidavit by the witness.)

Q. 97. Can you also produce any drawings or blue-

prints or the like, if such were made, by the York Manufacturing Company, in connection with your dealings with them pertinent to your said invention?

A. (Witness also produces a group of blueprints attached to the papers marked "York Manufacturing Company Correspondence and Affidavit of Thomas Shipley for Identification.")

Mr. Blakeslee: We offer in evidence the group of blueprints last mentioned and the papers marked "York Manufacturing Company Correspondence and Affidavit of Thomas Shipley for Identification," as "Complainant's Exhibit Lyndon-York Manufacturing Company Correspondence and Blueprints and Identifying Affidavit."

(The said group of blueprints last mentioned and the papers connected therewith so offered in evidence are marked "Complainant's Exhibit Lyndon-York Manufacturing Company Correspondence and Blueprints and Identifying Affidavit," together with the title of the court and cause and the date upon which the said Exhibit was offered in evidence.)

Mr. Blakeslee: We also offer in evidence the early sketches just produced by the witness with the attached affidavit of the witness as "Complainant's Exhibit Lyndon Construction Early Sketches and Identifying Affidavit."

(The said sketches and attached affidavit are marked "Complainant's Exhibit Lyndon Construction Early Sketches and Identifying Affidavit.")

ask

Mar. 6, 1915. A. M.

Mr. Westall: Counsel for defendant objects to the offer of the papers which have been heretofore marked by the Examiner as "Complainant's Exhibit Lyndon Early Construction Sketches and Identifying Affidavit" and "Complainant's Exhibit Lyndon-York Manufacturing Company Correspondence and Blueprint and Identifying Affidavit," and to each and every of the purported affidavits, sketches, blueprints and other papers contained within the wrappers so marked, as not the best evidence, and upon the ground that no proper foundation has been offered for the introduction of secondary evidence. The purported exhibits or papers referred to are also objected to on the ground that they are not properly identified by the testimony of the witness, and that no proper foundation has been laid for their introduction. In addition to the objections before noted, the affidavits are objected to as being an attempt to insert into the record testimony by ex parte affidavits, thus depriving defendant of the right of cross-examination of the purported signers of the affidavits in question. It is particularly pointed out to counsel in making this objection that this testimony is taken under a stipulation, and that the introduction or attempted introduction of evidence in this form is not in accordance with the stipulation. It is also specifically objected that there has been no sufficient foundation laid for the introduction of purported copies of the correspondence of the American Trading Company contained within the wrapper marked "Complainant's Exhibit Lyndon-York Manufacturing Company Correspondence."

1848 31 add "together with the title of the court and cause and the date upon which said exhibit was offered"

sel's objection that, of course, we do not stand upon the affidavits, being part of these exhibits, as proof of the statements therein made under oath. These affidavits are put in evidence merely because they are attached to and have for some time been attached to the papers and other documents with which they are now connected. And as to the facts of these affidavits and the establishment of the other evidence contained in the several papers and documents of these two exhibits, we will furnish further proofs as the same may be deemed necessary before closing complainant's rebuttal case. Counsel is aware of the fact that these various persons whose testimony would be competent in these matters are scattered all over the country, and that it is impossible to proceed in taking their testimony with what might be the most logical sequence. However, we are only relying on the present witness in connection with those exhibits for his best testimony with respect to the same, and are not attempting to bridge by means of said deposition the gaps which might be properly filled in by the testimony of other witnesses. We shall proceed, of course, to inquire of the present witness with regard to these exhibits merely as to his own knowledge and rely upon such further witnesses as we shall deem it proper to call to go further into the establishment of the facts and evidence further pertinent to these exhibits.

Q. 98. Have you prepared the sketch requested of you yesterday in reproduction of the matter which you disclosed to Mr. Meyer with sketches during June or July, 1898, at the Westchester restaurant on Williams Street, New York City?

A. Yes. I have made a sketch, and so produce it.

Q. 99. I notice that you have placed upon this sketch various designating matter and wording. Will you now, please, generally describe what this sketch portrays, quoting the wording on the sketch in your answer and adding to the sketch any such further indicating symbols or wording as you may wish to weave into your description of it, and in connection with such description stating generally the mode of operation of the organization portrayed in the sketch?

A. This sketch is as nearly in accordance with the general character of the sketches which I am accustomed to make when explaining any mechanical or electrical device to another engineer, or otherwise technically-trained mind, to whom it is not necessary to trace all the details; and I believe it to be the same character of sketch as I made seventeen years ago in the Westchester restaurant to indicate to Mr. Meyer the ideas I had at that time. On the sketch which I made for Mr. Meyer there was no designating wording, as the explanation of the operation was entirely verbal. This sketch shows first a turbine case and a shaft projecting from the center thereof, which is meant to indicate the main drive-shaft of the turbine. From the turbine case there also projects a second shaft which is meant to indicate the gate shaft, which shaft is the operating shaft of the main turbine gates. These latter are not shown, it being assumed that any engineer knows that they must exist. Connected with the gate shaft is a bevel gear which meshes into two other bevel gears, these two latter being on the same shaft a short section only of which is shown. This short shaft is understood to be driven from some source of power, preferably the turbine itself.

The two bevel gears on this short shaft are loose on the shaft, and arranged to be clutched so that either one or the other would be constrained to rotate with the shaft, and, therefore, motion of the gate shaft would follow the direction of such motion, depending on which of the two bevel gears is constrained to rotate with the shaft on which they are mounted. The clutch which operates with either of these two bevel gears is moved to one side or the other, as conditions may require, by a lever, and this lever is operated by a pair of electro-magnets which are diagrammatically indicated as being mounted at the opposite ends of the bar connected with the end of the lever, opposite to the clutch-moving end of the lever. From this diagram it follows that the direction of motion of the gate shaft will be fixed by whichever of the magnets is energized. In this sketch is also roughly indicated and shown a shunt-wound dynamo, the armature of which is meant to be driven from the turbine shaft. The magnetic circuit of this dynamo, which is not here shown, would be designed to work well below magnetic saturation, so that the intensity of field magnetization would respond to changes in the magneto-motive force of the field winding, and almost as a direct or straight line function. Therefore, the voltage of this dynamo would vary much more rapidly than the speed changes which might cause the voltage changes, because not only would the speed of the armature rotating in the magnetic field be changed, and the voltage proportionately changed from this cause, but such change in the electro-motive force of the armature would also produce a corresponding change in the magnetization of the field itself, and it was anticipated that the change in

voltage would be very nearly proportional to the square of the change in speed. The armature of this generator is shown as connected to the terminals of a solenoid controlling magnet. Magnets of this type being seldom worked to the point of saturation, the pull changes very nearly in proportion with the square of the impressed electro-motive force. The core of this solenoid is shown connected with an oscillating lever at either end of which are indicated electrical contacts. The core of this solenoid has its pull opposed by a spring which is also connected to the oscillating lever. Under normal conditions the voltage of the generator would produce the pull on the solenoid which would just balance the opposing pull of the spring. An increase in the speed of the water wheel would produce an increase in the speed of the dynamo with a corresponding increase of voltage of the dynamo, and from this would result a greatly increased pull on the solenoid core, overcoming the pull of the spring and causing motion of the oscillating lever. This oscillating lever, when moved, will cause contacts to be closed at one end or the other, as the case may be. By following the circuits indicated it will be seen that when the oscillating lever moves in one direction and makes the contacts which result from motion in this direction, current will pass through one of the magnets which operates the clutch, which, in turn, causes operation of the gate shaft; while when the oscillating lever moves in the other direction, making the contacts which result from motion in this latter direction, the other magnet which causes operation of the clutch, which, in turn, causes movement of the gate shaft, will be energized. In addition to these features there is shown a short piece

of shaft which is intended to indicate that this short piece of shaft is a part of the governor mechanism, and which might be either one of the main shafts of the governor, or an auxiliary shaft. On this is mounted a pair of friction discs, one of the discs being attached to the piece of shaft and the other disc loose on it. These parts I have designated as "Friction Returning Device." When the oscillating lever, before referred to, moves so that the left hand end is depressed, it not only makes a contact to cause motion of the gate shaft, as before described, but it also makes a second contact which energizes a magnet, and the pull of this magnet through the intervention of the lever is meant to cause a pressure between the two discs, and, therefore, that disc which is loose on the shaft tends to rotate with the shaft because of the friction between it and the other mating disc, which latter is fastened to the shaft and constrained to rotate with it. Movement of this friction disc causes movement of the rod which is attached to a pin placed somewhere near the periphery of the disc. A movement of this rod produces a compression of one of the springs which is shown, which spring reacts against the oscillating lever, tending to push it back to normal position from which it was moved by the change in pull of the controlling solenoid. While this sketch does not indicate it, a similar contact for operating the friction returning device was meant to be understood as placed on the opposite end of the oscillating lever also, it being unnecessary in a description to a trained engineer to indicate more than one of several duplicate parts. These are the important features of the gate-moving device itself. In addition to these, the by-pass with the

butterfly valve was shown as indicated, and, if my memory has been correct in the reproduction of this sketch, there was no operating means shown in the original sketch in which I disclosed my invention to Mr. Meyer, for moving the by-pass valve. As far as I can remember, I indicated to him verbally that the by-pass valve would be arranged to move quickly, and, substantially, with the same rapidity as the main water-wheel gate, in the operation of governing; but that after the water-wheel gate had finally reached its new position of gate opening, the by-pass valve would then return slowly to its normal position. That is, the conception of the by-pass valve as operated by the water-wheel governor itself, and a slow return to normal position after governing was completed, were the fundamental elements of the conception I had on the day I first invented this device and disclosed it to Mr. Meyer. The actual mechanical means by which this could be accomplished, I believe did not take definite form for several days—possibly a week after that day.

Q. 100. What was the normal condition of the gate-shaft clutch mechanism to be?

A. The clutch mechanism would stand approximately in a mid-position between the two bevel gears, so that neither would be engaged.

Q. 101. You have referred in your description of this sketch to an oscillating lever bearing contacts for closing several electrical circuits. Will you please mark this part with the words "Oscillating lever."

A. (Witness does as requested.)

Q. 102. I notice you have applied in this sketch the character "X" to the turbine wheel shaft, and have also

applied the character "X" to the shaft of the armature of the generator utilized for energizing the electro-magnets for operating the clutch mechanism last referred to and for energizing other features of this system. What does the use of this character "X" imply?

A. It implies that they are mechanically connected together so that rotation of one is always attended by rotation of the other. In other words, the dynamo is driven from the main turbine shaft.

Q. 103. And that because of what general relation between the speed of the turbine shaft and the rate of rotation of the armature of this generator?

A. They would always preserve a fixed relation to each other, and any change in the speed of the turbine shaft would be attended by an exactly proportional change in the speed of the generator armature.

Q. 104. Then is it or is it not proper to refer to this generator and its armature as a speed-sensitive governing element?

A. That term, to my mind, correctly defines the combination.

Q. 105. I note that you have provided upon this sketch arrow lines connecting the gate-shaft clutch mechanism and features associated with the by-pass elements, such line being designated "Inverse Connection." What does this wording signify?

A. It signifies that the by-pass valve is meant to be moved from its normal or predetermined position by the governing mechanism.

Q. 106. In what relation as between these two elements?

A. In an inverse relation. That is, motion of the water-wheel gate in a direction to reduce or close the gate opening would be attended by a corresponding opening of the by-pass valve, both of these being operated from the one governing mechanism.

Q. 107. I notice that you have provided upon this sketch an element designated "Dashpot." What is the significance of this showing?

A. That is meant to indicate that the movement of the by-pass valve in returning to its normal position is retarded by some means in which a time element is necessary for the operation to take place. The dashpot is the simplest and best known of the time-element devices. Hence its inclusion in this sketch.

Q. 108. Are we to understand that what you have described or stated was the effect of the construction and operation of the several features and elements and groups of features as shown in this sketch now under consideration, constitutes in general substance the disclosure which you made to Mr. Meyer in June or July, 1898, at the Westchester restaurant in New York?

A. All of the portions which I have here shown, with the exception of the by-pass valve, formed my first disclosure to Mr. Meyer, and it was during the conversation about these portions of the proposed governor that the by-pass valve was added to the sketch, and sketched in as indicated. So that the final disclosure made to Mr. Meyer on the same day at this same time before mentioned, was in accordance with the parts and operations indicated on this sketch.

Q. 109. You have stated in your recent testimony that another contact device which you provided on the

oscillating lever, with a suitable circuit to cause action of the friction returning device upon movement of the oscillating lever in a direction the reverse of that causing operation of the friction returning device by means of the contact shown in the sketch on the other end of the lever. In order to get this operation of the friction returning device on the other side of the case, or upon such reverse movement of the oscillating lever, would it be necessary to do anything further than duplicate what is shown in this sketch with respect to the control of the friction returning device.

Mr. Westall: Objected to as leading.

A. No; there would not be. That is the reason why this additional set of contacts was omitted from the original sketch.

Q. 110. By Mr. Blakeslee: Then am I to understand that the friction returning device was to be utilized in connection with governing action upon both increase and decrease of speed of the water-wheel?

Mr. Westall: Objected to as leading and suggestive.

A. It was intended to be operated in either or both directions.

Q. 111. By Mr. Blakeslee: In other words, was it intended that this should operate as desired in connection with either speed correction?

Mr. Westall: The same objection.

A. Yes.

Q. 112. By Mr. Blakeslee: In the matter of this sketch and the matter of your detailed disclosure, including that of the sketch, to Mr. Meyer, at the time stated in 1898, did any parts, features or elements of construction or inter-relation, require to an engineer or

one skilled in the art any further detailed description in order to fully inform such person of the working system and construction?

A. I should say to one skilled in the art that this sketch or its equivalent would be complete information as to the functions to be fulfilled and the methods whereby they would be fulfilled. The sketch does not show nor does it purport to show the exact mechanical details which would enter into the construction of the machine, nor would the indication of these details help to understand the device, it being well known that with a multitude of mechanical movements and devices the same function can be obtained in numerous ways, and the question of actual machine design after an invention is made is a matter of personal judgment.

Q. 113. And were each of the parties, Meyer, Reid, Edward Lyndon, Merrill and the others whom you have mentioned as having been recipients of the general disclosure of your invention of the patent in suit, such persons as were qualified to receive such disclosure and understand the possible embodiment of the same into working construction?

A. Every one of the parties mentioned, to whom I disclosed this invention, was a technically educated man and one whose profession or business was engineering or lines allied with it, with the exception of my brother, who, at the time, had not yet left college, but was taking an engineering course at the University of Georgia.

Q. 114. How does the matter of the sketch still before us compare, generally, with other sketches you made disclosing the invention of the patent in suit to Mr. Reid, your brother and such other persons as you

have testified you did disclose the invention to, in the year 1898?

A. Just how far it would parallel such sketches, it would be impossible at this date to say. I believe that sketch to represent very closely the sketches which I did make at the times you have mentioned in your question, because I revealed to each of these parties all of the important features of the invention, described the operation of the proposed machine, and made sketches to illustrate the various operations of the machine. The sketches of any engineer are almost as characteristic as his handwriting, and it is possible among engineers who know each other intimately and know each other's work to determine, what engineer made a certain sketch merely by the personal characteristics, which are like the personal characteristics of his handwriting. I therefore believe that this rough sketch which I have made is very similar to all the other rough sketches which I made for the purpose of illustrating the device and functions of this invention.

Q. 115. From your knowledge and experience in connection with the discussion between engineers and technically educated persons relative to devices of mechanisms and apparatus of various kinds, is the subject of this sketch one which could well be disclosed by one technically educated person to another, and received by him intelligently even without the aid of pictorial representation?

A. Yes; it is perfectly practicable to describe to an engineer the whole of this device so that he will understand it, without any pictorial representation at all. It however, would require a much longer time, and be much

more difficult to do, than to make a sketch for the purpose of illustration.

Q. 116. Are there any details shown in this sketch or entering into your said disclosure to Mr. Meyer and others, pertinent to the invention of the patent in suit, or any details of construction disclosed in the patent in suit, "Complainant's Exhibit A," which, considered from the standpoint of work-shop practice, were not well known in the art and other allied arts at the time you conceived of and disclosed first to others the invention of the patent in suit?

A. I know of no element that entered into the make-up of this invention that required the production of a new mechanical device or electrical device to make up an operative machine.

Mr. Blakeslee: We offer in evidence the sketch lately under discussion with the witness, and ask that the same be marked "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketches of June and July, 1898."

Mr. Westall: Counsel for defendant objects to the introduction of the sketch referred to on the ground that it is not the best evidence, and upon the further ground that there has been no proper foundation laid for the introduction of secondary evidence, and on the ground that it has not been sufficiently shown to be an accurate representation of any sketches alleged to have been made by the witness prior to the granting of the patent in suit.

Mr. Blakeslee: Without argument, we merely point out in this connection that the record shows that the witness has not in his possession or under his control the

original sketches attempted in this sketch to be reproduced, and that the witness has testified that his early records of this invention in the year 1898 have largely been disposed of long ago.

(The said sketch so offered in evidence is marked "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketches of June and July, 1898," together with the title of the court and cause and the date upon which the said sketch was offered in evidence.)

Q. 117. By Mr. Blakeslee: Returning again to the question of your disclosures to others pertinent to the invention of the patent in suit, have you anything further to say in this connection, particularly with respect to one Frank A. Wunder, if you know him?

A. Wunder at that time, and, as I believe I have previously testified, was manager of the New York office which was also the Export office of the Ft. Wayne Electric Company. I met Mr. Wunder very shortly after my return to America in May, and it was prior to my departure from New York for Athens, Georgia, during the summer of that year. I disclosed this invention to Mr. Wunder, but I cannot state at what date. Mr. Wunder, although manager of the Ft. Wayne Electric Company's office in New York, is not a technically educated man, and, while he at that time had a considerable amount of general knowledge of machinery and electricity, he was not, I believe, sufficiently well equipped to receive fully the disclosure which I made to him. I did not at that time know Mr. Wunder's limitations in this direction, and it was not until sometime later that I concluded that he had only partly apprehended the explanation I had given him of my invention.

Q. 118. Referring now to "Complainant's Exhibit Lyndon Early Construction Sketches and Identifying Affidavit," will you please state when, where and under what circumstances you made these sketches, and point out by corresponding characters, numbers or letters to be applied to the sheets of these sketches the general elements or groups of elements therein disclosed, and state briefly the intended operation of the parts and, in the first place, please mark these sheets by consecutive Roman numerals from the top one to the bottom one, and use these numerals in referring to the sheets.

A. These sketches were made while I was Chief Engineer of the American Trading Company with office at 100 William Street, New York, and to the best of my memory were made at that office. They were made for the purpose of guiding the designers in the draughting room of the York Manufacturing Company, so that there could be prepared shop drawings from which the actual commercial machines could be produced. These sketches have been designated with Roman numerals from I to V, inclusive.

Sketch III is a suggested general assembly of the machine itself, the controller not here being shown. The main drive pulley intended to be driven by the water-wheel shaft is on the left of the machine. The journals of the various shafts are indicated, as is customary, by rectangles with diagonal lines running across them. there is indicated a journal just to the right of the main drive pulley. Adjacent to this journal and on the same shaft as the main drive pulley is a grooved sheave pulley marked "Dynamo Driver," from which sheave pulley it was intended that the controlling dynamo would

be driven, a round-belt multiple drive being adopted so that there could not possibly be any belt slippage between the controlling dynamo and the main shaft. To the right and adjacent to the dynamo driver is shown a second journal and adjacent to this journal on the same shaft a collar "a". Next to this collar is the hub of a bevel gear mounted on the shaft, and loose on it, so that the shaft may rotate freely without turning the bevel gear. At the extreme right hand end of the shaft is a journal, and to the left adjacent to this journal another collar, also, marked "a", and against this collar and adjacent to it is the hub of a second bevel gear which I now mark "Bevel Gear." The two bevel gears on this shaft are separated a distance apart such that they both are enabled to mesh with a third bevel gear on a second shaft at right angles to the first shaft, the two first-named bevel gears meshing on the opposite sides of a diameter of the third-named bevel gear, which I now mark, "Large Bevel Gear." The bevel gear on the right hand end of the shaft similarly with the first-named bevel gear is loose on the shaft, and the shaft may rotate freely without turning it. Between these two bevel gears is a sleeve which is keyed to the shaft and constrained to turn with it, the ends of this sleeve being tapered to fit into the mating tapered recesses in the hubs of the two first-named bevel gears. This sleeve is free to slide longitudinally on the shaft, and in the middle of it a groove is formed which runs girthwise around the sleeve, and in this groove fit small rollers which latter are fastened to a jaw which embraces the sleeve so that the sleeve is free to turn, but any motion of the jaw in a direction parallel with the axis of the shaft will

cause the sleeve to move also axially along the shaft. The jaw carrying the rollers forms one end of a lever pivoted at some distance away from the jaws, and the lever is extended past this pivoted point, and on the end thereof opposite from the end on which the jaw is fastened, a laminated iron armature is attached, which, in its normal position, is half-way between the poles of two electro-magnets, one being set on either side of the armature. It is obvious from this drawing that if one of the magnets is energized the armature will be attracted to it, the lever caused to turn about the pivot, thereby sliding the before-mentioned sleeve axially along the shaft, and causing the tapered end of the sleeve to engage frictionally with the tapered recess of the hub of the bevel gear towards which the sleeve is moved, thereby causing that one of the bevel gears to rotate with the sleeve and with the shaft. Rotation of this bevel gear produces rotation of the third or large bevel gear in a direction which is fixed by the direction of the rotation of the main drive-shaft. I now mark the electro-magnets just referred to "Electro-Magnets." It is also obvious that if instead of the first-named electro-magnet the other one be energized, the lever will move in a direction opposite to that in which it first moved, the sleeve will slide along the shaft in a direction opposite to that in which it was first caused to slide, and thereby frictionally engage the other small bevel gear, and in this manner cause the large bevel gear with which it meshes to rotate in a direction opposite to that in which it is made to rotate when the first-named bevel gear is engaged. In this manner the second shaft on which the large bevel gear is fastened is caused to rotate in one direction or

the other, according to which one of the electro-magnets is energized. Following now the second shaft from the large bevel gear upward, the following devices are mounted on it: First, a journal; next, and adjacent to that, a collar; next to the collar a pair of friction discs, which I now mark "Friction Discs." After these comes a worm, and after the worm a journal. This worm meshes with a worm-wheel which latter is mounted on a third shaft at right angles to the second shaft and parallel with the first-named shaft. I now mark these shafts, "First Shaft," "Second Shaft," and "Third Shaft," respectively. On this third shaft, passing from left to right and in order, are, first, the worm-wheel before mentioned; next, a journal, and next a disc, over a portion of which is a lever that is placed above and at right angles to the third shaft next, a friction clutch which is attached to and forms a portion of the disc just mentioned, the clutch comprising two portions, one being loose on the shaft and the other keyed to the shaft, but capable of being moved along the shaft in the axial direction; next comes a journal, and, finally, one-half of a flange coupling, which flange coupling is meant to mate with and be bolted to a similar half of a flange coupling on the gate-shaft, so that the rotation of the third shaft will also cause rotation of the gate-shaft. And since the third shaft is driven by the second shaft through the worm and worm-wheel gearing, and, furthermore, the second shaft is capable of being rotated in either direction, depending on which one of the electro-magnets is energized, it follows that the gate-shaft is moved whenever an electro-magnet is energized, its direction of movement depending on which of the magnets is ener-

gized, and the duration of movement depends on the period of time that electric current is supplied to one of the electro-magnets. It has been before mentioned that the armature which cooperates with these magnets is of laminated iron. The magnetic circuit of the magnets is also of laminated iron, and the laminations are clearly indicated in the sketch. The object of using a laminated magnetic circuit is to insure the instantaneous release of the armature by whichever magnet it may be attracted to as soon as current through the winding around the magnetic circuit is interrupted. It will be noted that on either side of the lever which carries the armature, at one of its ends is a spring. When the lever is moved in either direction the spring on that side of the lever towards which motion takes place, is compressed, so that the magnetic pull must not only move the sleeve to engage one of the bevel gears, but must also overcome the pressure set up by the compression of the spring. When the current through the magnetic winding is interrupted, and the magnetic pull ceases to exist, the spring pressure will cause the lever to move back to its middle or normal position, thereby releasing the bevel gear from frictional contact with the rotating sleeve.

Referring now to the friction discs on the second shaft, one of these discs is keyed to the shaft and constrained to rotate with it, but is free to move along the shaft. There is an arrangement of a groove in the hub of this disc, rollers running in the groove, a lever with a jaw to the ends of which jaw the rollers are fastened, a pivot about which the lever can partially rotate, an armature on the end of the lever opposite to that on

which the jaw is placed, and an electro-magnet which, when energized, will attract the armature and cause motion of the lever, and, therefore, of the disc, all being in a measure similar to the previously described lever, jaw and magnetic arrangement whereby the sleeve on the first shaft is moved, providing a means of pressing the disc which rotates with the shaft against a second disc which bears against a collar on the second shaft. This second disc is not fastened to the shaft, and the shaft may rotate freely without causing the disc to move with it. When, however, the electro-magnet which I now mark "Friction Returning-Device Magnet" is energized, and the disc with which the lever cooperates is pressed against the second disc, the latter is constrained to rotate with the shaft, providing the force which opposes its rotation be not greater than the force which causes it to rotate, which latter force is proportional to the pressure between the two discs and the coefficient of friction between them. On the second disc there is indicated a crank pin with the end of a lever or rod attached. The direction of this lever in this drawing is perpendicular to the plane of the paper, so that only the cross-section of a round rod attached to a crank pin is indicated at the point I now mark "b". Considering this rod as perpendicular to the plane of the paper, it is obvious that the rod will be moved upward or downward, depending on the direction of the motion of the second shaft, provided the friction returning-device magnet is energized. This rod is the rod which is indicated in Sketch V, which latter sketch shows fully the function of this rod, and which I will discuss later more fully

when describing the Sketch V, and which I now letter similarly "b".

Passing now to the disc clutch and lever arrangement shown on the third shaft, there is a sheave wheel which I now mark "e" and which in the sketch lies directly under the lever, which lever I now mark "d". The groove in this sheave wheel does not show, because of the position of the lever "d" over it. The sheave wheel is fastened to and is a part of the clutch, which I now mark "e". This portion of the clutch, together with the sheave wheel to which it is attached, is free, so that the third shaft can rotate without causing any rotation of these parts. The sheave wheel is meant to carry a wire rope connection to the lever on the shaft of the butterfly valve in the by-pass pipe. The disc which I now mark "f" is provided with two projecting pins which are placed at opposite ends of a horizontal diameter of this said disc "f". The lever "d" which is pivoted at the point which I now mark "g" carries at its opposite end a weight, which I now mark "h"; this weight being arranged to slide along the length of the lever and thereby vary its moment about the pivotal point "g". Normally, this lever rests upon the two pins in the disc "f" and near its periphery. Obviously rotation of the disc "f" in either direction will raise the lever, causing it to turn around its pivotal point "g", lifting the weight "h". It is also obvious that if the lever be raised by the rotation of the disc "f", and the force causing this disc to rotate be removed and the disc be free to turn that the moment of the force produced by the weight "h" on lever "d" pushing against that one of the pins in the face of the disc "f" which has caused the lever to be

raised will rotate the disc "f" back to its normal position, which normal position is reached when the lever rests on both the pins before mentioned. The friction clutch made up with the tapered recessed portion "e" attached to the disc "f" and the mating tapered portion which I now mark "j", together with a magnetically operated lever and jaw arrangement to slide the part "j" into and make frictional contact with the part "e" similar to the other magnetically operated friction devices which I have before described. Its method of operation is clear from this sketch. The electro-magnet which I now mark "By-Pass Operating Magnet" when energized, will cause the friction clutch "e-j" to engage, and the disc "f" together with the sheave wheel "c" is then caused to rotate with the third shaft. As soon as the current supplied to the winding of the by-pass operating magnet is interrupted, the clutch "e-j" releases and the lever "d" which has previously been raised by the rotation of disc "f" is caused to descend by the action of the weight "h", thereby returning the disc "f" to its normal position, and the butterfly valve in the by-pass being operated by the sheave "c", will also be returned to its normal position by the descent of the weight "h", and the before-described action of the lever which returns the disc "f" to its normal position. The butterfly valve being balanced and frictionless, will not retard or prevent this action from taking place.

Q. 119. How, and by what means, was the by-pass valve, in accordance with this sketch, to operate with relation to the main water gate?

A. In an inverse direction. For closure of the main water gate there would be opening of the by-pass gate.

Q. 120. And, generally, what caused that inverse relation? What established this inverse relation?

Mr. Westall: Counsel for defendant objects to the motions of counsel for complainant to the witness at different times of the examination, and the various signs which are made and which it is plain to read is an endeavor to coach the witness and put words into his mouth. I do not understand that it is proper in proceedings of this kind, and while the witness is on the stand, to carry on conversations not entered of record, and I believe counsel for complainant at a prior time has made an objection of that kind under exactly the same circumstances.

Mr. Blakeslee: We do not agree to this statement at all, and if counsel has any objection to make to any of the procedure in connection with the examination of the witness, we expect him to make it and make it specific. Counsel for complainant admits that he waved his finger in the air to signify that he wanted the witness to describe something doing, and is willing to be criticised in that respect. Captiousness requires it. We give notice to counsel for the defendant that we expect him to specifically object if he has objections to make at the time such objectionable procedure occurs. We deny that in any way we have coached the witness, although at times we have suggested off of the record that he provide reference letters, and designating characters and words, as he proceeded, in order to expedite the deposition. If there is any objection to this at any time, we expect counsel for defendant to speak out at the time.

(The question is read by the Examiner.)

A. The mechanical connection of the parts.

Q. 121. Namely, the train of parts you have described? Is that correct?

A. Yes.

Q. 122. How was the part marked "Main Drive" in this Sketch III, intended to be actuated, or from what source or prime mover?

A. From the water wheel itself, that this device is intended to govern the speed of.

Q. 123. What was to be the connection between the parts of this Sketch III and the water-wheel gates?

A. As I have previously testified, the connection between the machine as disclosed in Sketch III and the water-wheel gate was to be made by means of the flange coupling of which one-half is shown on the third shaft, and which I now mark "Flange Coupling."

Q. 124. And as the large bevel gear in this sketch was oppositely turned by the respective co-acting bevel gears, what was the effect upon the water-wheel gate through this part just marked "Flange Coupling?"

A. It caused the water-wheel gate to be opened or closed, according to the direction of motion of the large bevel gear, which, in turn, depended for its direction and motion on which of the two small bevel gears might be clutched to rotate with the first shaft.

Q. 125. And what was the effect of the parts, including the friction returning device magnet, upon the rotation of the second shaft?

A. The friction returning magnet device had in itself no effect on the rotation of the second shaft. It indirectly affected the direction of rotation of the second shaft acting through an electrical controller which I

have not described in connection with the description of these sketches numbered from I to V.

Q. 126. To what end did it so indirectly act upon the second shaft?

A. It acted to cause the electric circuit through whichever of the main operating electro-magnets might be energized to be opened before the controller mechanism normally opened them, and, therefore, to cause cessation of rotation of the second shaft before this cessation would normally take place.

Q. 127. And what was the object of that anticipatory cessation of rotation of the second shaft?

A. To prevent the governor from moving the water-wheel gates to a point of opening that would be greater or less than the opening required for the change in load that might come on the water wheel.

Q. 128. Such change in load causing what, in respect to the water-wheel operation?

A. Causing a change of speed.

Mar. 6, 1915. P. M.

Q. 129. Considering further the sketches of "Complainant's Exhibit Lyndon Early Construction Sketches and Identifying Affidavit," have you any further statement to make as to the construction, inter-relation and operation of the features shown in and by any of these sketches?

A. Yes.

Q. 130. Please proceed to do so in the same general manner as you have discussed Sketch III of these sketches.

A. Sketch I is a shop sketch for the operating electro-magnets the dimensions, number of turns and details

all being shown, and they are sufficiently clear and complete for this sketch to serve as a shop drawing and from it to produce the magnet complete.

Sketch II is a similar shop sketch of the laminated armature which is intended to cooperate with the magnet. This armature is the detailed armature drawing shown in Sketch III between the two electro-magnets on the end of the lever which operates the sleeve on the first shaft.

Sketch IV, also marked Sketch 42B, is as indicated by the legend on this sketch, a detail of a weight and lifting collar, through a hole in which weight a rope is passed. This represents a modification of the method of returning the by-pass valve to its normal position, and is meant as a substitute for the weighted lever "d" shown in Sketch III. As indicated in Sketch IV, the rope may move in one direction, passing freely through the weight, without moving it; but, if moved in the other direction, the lifting collar will catch against the under side of the weight so that the weight will be then lifted with the rope. The rope is meant to be actuated from the sheave wheel "c" of Sketch III when clutch "e-j" shown in Sketch III is brought into operation and the rope to the by-pass valve moved, causing movement of the by-pass valve, and, at the same time, the weight surrounding the rope shown in Sketch IV is lifted, and subsequently the clutch "e-j" is released the weight descends, bringing back with it the rope by reason of the fact that the weight rests on the lifting collar which is attached to the rope. This sketch was made sometime subsequent to the Sketch III, as evidenced by this proposed modification of the original device shown in the Sketch III to accom-

plish this same object. A number of variants of the originally proposed mechanical arrangement suggested themselves, and in some of the final shop drawings made by the York Manufacturing Company, which have been put in evidence, other mechanical arrangements for accomplishing this same purpose have been adopted. In all of these, however, the original idea of a lifted weight returning slowly to its normal position in order to bring the by-pass valve also slowly to its normal position has been preserved. In Sketch III the means used to adjust the time of return to normal position of the by-pass valve is shown as a dashpot, the piston of the dashpot being connected to the lever "d" as indicated in the sketch, and which I now mark "Dashpot."

Sketch V shows the contact-making and controlling mechanism. A Solenoid core which is marked on the sketch "Soft Iron" is surrounded by an insulated-wire winding or solenoid, as indicated. The core is suspended and its weight practically balanced by the upper spring which I now mark "Spring No. 1." This spring in turn was to be suspended to a screw-eye supported by a bracket through which the threaded portion of the screw-eye would pass, and above the bracket, as is indicated, are two nuts, one which served to adjust the position of the suspending spring No. 1, and, therefore, the location of the soft iron solenoid core, the other nut being a jam nut to prevent the adjustment from being disturbed in operation. Connected with the solenoid core is shown a jointed rod which is screwed into the center of the core and extends vertically downward from it. A short distance below the core is a lever, the normal position of which is horizontal. It is pivoted about its

middle point as shown, and which point I now mark "Pivot No. 1." A connection is made between this downwardly extending or operating rod and the horizontal lever, so that when the solenoid core is caused to move upward or downward the lever will oscillate about its pivotal point, lifting one side and depressing the other, depending on the direction of motion of the solenoid core. At either end of the horizontal lever is fastened a contact point, which point dips into an mercury contact cup. As indicated, the length that these points project beyond the lower edge of the lever, is adjustable by means of the nuts which screw onto the threads formed on the upper end of the contact points. These contact points are meant to operate the main controlling magnets and the short lengths of wire connected with them are marked on the sketch "To Controlling Magnet." From the drawing it is clear that motion of the soft iron core in the solenoid will cause electrical connection to be made to one or the other of the controlling magnets before referred to and shown in Sketch III, the magnet energized depending on the direction of motion of the soft iron core. Passing through the lever, and on the opposite side of the pivot from that side on which connection is made with the operating rod, and which lever I now mark "Lever No. 1," is a rod which is the same as the rod "b" which has before been mentioned in my description of the part shown in Sketch III, and which I have also marked "b" on this Sketch V. Surrounding this rod are two springs, one is placed above the lever No. 1, and the other below it. It is obvious that if rod "b" be pushed upward the lower spring will be compressed and tend to force lever No. 1 to turn about pivot

No. 1 in a clockwise direction. If the solenoid core had previously been pulled upward, the lever rotated with a counter-clockwise direction, and the left hand contact to one of the controller magnets closed, and subsequently the rod "b" were moved upward so that the lower spring would be compressed, the force set up by the compression of this spring would tend to neutralize and overcome the force exerted by the magnetic pull on the solenoid core, which force had previously overcome the lower spring at the bottom of the actuating rod, and which spring I now mark "Counterbalance Spring," thereby lifting the actuating rod and causing the motion of lever No. 1 to close the left hand contact. The parts are all intended to be in equilibrium and substantially in the positions shown in the sketch when the speed of the controlling dynamo, the driver of which is shown in Exhibit III and which I have elsewhere previously described, is at its normal value. An increase in the speed is followed by an increase in the voltage, and, therefore, the pull of the solenoid core shown in Sketch V is increased; and if this increase in pull be sufficient, the pull of the counter-balance spring and the friction of the moving parts will be overcome, motion of the lever will ensue and the left hand contact be closed. The closing of this contact will energize one of the actuating magnets and the arrangement of connections is intended to be such that the magnet thus energized is the one which causes the motion of the gate shaft to take place in such a direction as will tend to close the gates, and thereby reduce the speed of the water wheel. As the speed of the water wheel begins to diminish, the pull of the solenoid begins to diminish also; and, in the course of time

when the speed of the water wheel returns to normal, the action of the counter-balance spring would bring the lever and solenoid core back to their normal position. If, however, there were no auxiliary device, the momentum of the moving parts of the water wheel and water-wheel gate would cause the governor to continue acting, and thereby move the gates a greater distance than the change in load demands. It therefore is necessary, in order to prevent such over-running, to bring into play an auxiliary force which tends to move the lever back to its normal position and oppose the pull, either of the solenoid core or the counter-balance spring, whichever may predominate, so that the lever may be returned to its normal position before the water wheel has returned fully to its normal speed. The springs shown above and below lever No. 1, moved by the rod "b", are intended to accomplish this result. I have previously explained in a description of the friction discs on the second shaft in Sketch III, how it causes a movement either upward or downward of the rod "b", and with this explanation, taken together with the sketch, it is obvious that motion of the water-wheel gate shaft is attended by motion of the rod "b" and therefore by a ^{friction} ~~comparison~~ of one or the other of the two springs on rod "b", and which press against the lever No. 1. There is also indicated, merely diagrammatically, however, two returning springs on rod "b" which are meant to be separate from the two springs that act on lever No. 1. The function of these two returning springs is simply to return rod "b" and with it the friction disc to which it is attached, to its normal position after the pressure between the friction discs is relieved, and in the usual and well-

known manner of using two opposing balance springs for this purpose. In addition to the two main contacts shown on lever No. 1, there is another contact shown on another lever, which I now mark "Lever No. 2." The mechanism indicated and its method of operation would be obvious from the sketch. Any motion of the solenoid core, whether upward or downward, would cause the right hand end of the lever No. 1 to descend, thereby closing the electrical contact and establishing an electrical connection through this contact to the auxiliary magnets, that is, the magnet operating the friction returning device and the magnet operating the by-pass friction clutch, so that any motion of the solenoid in either direction will cause both the friction discs, operating the returning device, and the friction clutch, operating the by-pass valve, to become engaged. An auxiliary contact is also provided, as shown detached in the lower left hand corner of the sketch. The iron point which dips into the mercury cup is fastened through a lever, which I now mark "Lever No. 3." This lever normally is in a horizontal position, and in this position the contact point dips into the mercury and contact is thereby permanently made except when interrupted. A vertical rod adapted to rise upward to engage on the under side of the lever, thus lifting it together with the contact point so as to break the connection, is shown and marked in the sketch "To Clutch Release on Second Shaft." The object of this contact and this lever is to prevent excessive wear of the friction surfaces on shaft No. 2, which operate the returning device. In the mechanism as conceived by me, I desired to make the strength of the magnets operating the main friction clutches which cause

engagement of the gear wheels on the first shaft, as small as possible, and this required that the shaft have as high a speed as mechanically practicable and suitable. In order to reduce this speed sufficiently to operate the gate shaft, a reduction gearing was necessary, and I have shown in Sketch III and in other drawings the use of the worm and worm wheel for this purpose. From Sketch III it is obvious that there will be a great many revolutions of shaft No. 2 to produce one revolution of gate shaft No. 3. The friction discs which operate the returning device are placed on shaft No. 2, so that the returning device will come into play almost instantly when governor movement begins. Obviously the motion of the friction disc to which the vertical rod "b" is attached, is limited to something less than 85 degrees from normal in either direction. The returning springs on rod "b" are meant to be of such strength and the separation between the coils of the springs of such width that when the proper distance of rotation of the friction disc to which the rod is attached has been reached, the rod can move no further and rotation of the friction disc is arrested. This point, as stated, will be reached after shaft No. 2 has turned through between 80 and 85 degrees. Obviously shaft No. 2 would make at least a complete revolution, if not a large number of complete revolutions, for each operation of governing. In this case the friction between the two discs of the returning device would be rubbed together with the pressure between them set up by the magnet, and this in the course of time would cause considerable wear on these discs. With the arrangement as indicated in Sketch V. however, this wear is almost entirely eliminated by reason of the

fact that the rod marked "To Clutch Release on Second Shaft" is lifted by the movement of the returning device of the disc, and when this disc reaches its maximum degree of rotation as previously determined, and for which it would be adjusted, any further movement would cause the rod which I now mark "Release Rod" to move upward, lifting lever No. 3 and opening the contact at the end of that lever. This contact is interposed in the electrical circuit from the contact on lever No. 2 to the magnet of the friction returning device. From these considerations it follows that when the maximum point of rotation is reached by the friction disc to which rod "b" is attached, any further movement opens the circuit to the friction-disc-actuating magnet and releases the pressure on it, thereby leaving the disc to which rod "b" is attached free to start to return to its neutral position. When it begins to return, release rod "b" moves downward, contact is again made, and pressure re-applied. It was expected that this cycle of operations would proceed with comparative frequency; and, the circuit being made and broken within very short intervals, taken with the time element of the magnet due to self-induction, would result in a partial reduction of the magnetic pull, thus reducing the grinding action between the two surfaces, or, at all events, if the time element of the magnet were not sufficiently great for this, the disc to which rod "b" is attached would be held in its maximum position by a series of impulses rather than one continual rotating force. This additional contact was in no wise necessary to the operation of the device, and, as stated, was merely a suggested arrangement for reducing possible wear between the friction surfaces.

Q. 131. By Mr. Blakeslee: To break in at this point.

A. I have finished.

Q. 132. Oh. Please state where, if at any place, this release rod and its associated contact device just described by you, finds its disclosure in "Complainant's Exhibit A," a copy of the patent in suit?

A. The rod in Fig. 1 of the patent in suit is marked "25" and "25a", the portion marked "25" being that portion which passes through the lever in the controller, and the portion marked "25a" being a jointed or connecting rod portion which is attached to the friction disc, and that in the patent drawing is marked "22."

Q. 133. Is there any counterpart of the rod "b" of Sketch V shown in the drawing of the patent in suit?

A. Yes.

Q. 134. Where is that shown?

A. It is that portion marked "25" and bearing on it the springs marked "27" and "28" which bear against opposite sides of the lever, and the returning springs which are merely roughly indicated in Sketch V are shown in the patent drawing and are numbered "29."

Q. 135. Is there any mercury contact device such as that shown in connection with the release rod in Sketch V shown in the drawing of the patent in suit? And, if so, where?

A. If it is, I fail to find it.

Q. 136. Then, if there any part in the patent in suit corresponding to the friction returning device magnet of Sketch III, and, if so, what?

A. Yes. It is the magnet marked "32" in the patent drawing cooperating with the armature "31."

Q. 137. Then, as I understand it, this auxiliary de-

vice, including the mercury contact applied to lever No. 3, associated with the release rod in Sketch V, was a further feature which you had in mind and one which was not incorporated in the disclosures of the patent in suit? Is that correct?

A. Yes. I did not consider that of any material importance, so far as a disclosure of the patent was concerned. And, in reality, in reducing this invention to practice, that release rod arrangement was not used.

Q. 138. Please state a little more fully what the further showing in Sketch V signifies, namely, those parts directly associated with lever No. 2.

A. Do I understand by that that you desire to have me describe more fully the mechanical movement of these parts, or the design of the contacts themselves?

Q. 139. What I wish to know, is, what the function of contact device associated with lever No. 2 was, and how it performed and for what purpose.

A. Motion of the solenoid core in either direction would lower the right hand end of lever No. 2, causing the metal stud on the end to dip into the mercury cup below, and thereby close the electrical circuit through both of the auxiliary magnets. That is, the magnet "32" of the patent drawing which operates the friction returning device and magnet No. 64 of the patent drawing which operates the friction clutch moving the by-pass valve. The operation of this controller is best explained by assuming a specific direction of motion. Let it be assumed that the speed of the water wheel is increased, due to a diminished load on it. The voltage of the controller generator would increase, thereby increasing the pull of the solenoid on the soft iron core, lifting the

right hand side of lever No. 1, closing the contact on the left hand side of lever No. 1, thereby starting the bevel gearing on shaft No. 1, which bevel gear will cause rotation of shafts Nos. 2 and 3, in a direction to close the gates. At the same time that lever No. 1 is moved, lever No. 2 will also be moved, and the magnets 32 and 64 of the patent drawing energized by reason of the contact at lever No. 2 being closed. Rod "b" almost instantly rises upward and compresses the spring on the under side of the lever No. 1, thereby applying a force which tends to restore this lever to its normal position as has before been described. Also, the by-pass valve is moved through the action of clutch 57, 58 of the patent drawing and the sheave wheel 54 connected to this clutch, the direction of motion being such that the by-pass valve is opened. The speed of the turbine will begin to diminish, and, due to the diminution in pull on the solenoid, together with the action of the counter-balance spring of Sketch V, pressure of the spring on rod "b", lever No. 1 is returned to its normal position, together with lever No. 2, which is also returned to its normal position, thereby opening all the contacts and releasing all the clutches so that the various described parts of the magnets are returned to their normal positions. It is probable, however, that governing will not have been completed, because the pull on the solenoid, even after this process just mentioned, will still be greater than the opposing pull of the counter-balance spring, due to the fact that all these contacts have been opened with the assistance of the auxiliary force, which proceeds from the compression of the lower spring on rod "b", and which force has been removed in advance of the com-

plete reduction of the magnetic pull to its normal value. Therefore, this same cycle might again follow, its time of operation being very short compared with the first or initial cycle.

Q. 140. Assuming in the operation of this mechanism which we are now discussing, that the pull upon the core of the solenoid due to the radical disturbance of the speed of the water wheel operating the generator energizing the solenoid, is sufficient to oppose any immediate core movement through movement of lever No. 1 under the attempted action of the returning device, and that governing action persists, what will be the action of the co-engaging surfaces of the friction discs of the returning device?

A. The friction discs will continue to rub together, one being constrained to move with the shaft and at the same angular velocity, while the other having reached its position of maximum travel will be arrested in its rotation, and there will be a continuous rubbing action as long as governing persists.

Q. 141. And in that way is it correct to say that this rubbing action will be accompanied by a slippage between these discs which will accommodate such persisting governing action until this slippage terminates, due to a response of lever No. 1 to the frictional efficiency of the said friction disc?

Mr. Westall: Objected to as leading and suggestive.

A. The question is not clear to me, as it stands.

Q. 142. By Mr. Blakeslee: I will withdraw the question and put the following: Now, consequent upon the slippage due to the rubbing action of the friction discs of the returning device, when will this returning

device become effective to actuate lever No. 1 and move the core of the solenoid?

A. The action to return lever No. 1 to its normal position would begin to manifest itself after the shaft No. 2 had rotated between 15 and 20 degrees. After about 80 to 85 degrees of shaft rotation, the pressure set up by the springs of the returning device against lever No. 1 to cause it to return to its normal position, will have reached its maximum and will remain there until the lever itself is returned to its normal position. Therefore, this returning force comes into play almost instantaneously, or within an inappreciably short time after movement of the shaft No. 2 begins, as compared with the length of time required to move the water-wheel gates. My memory is that the speed of shaft No. 2 was expected to be 300 revolutions per minute or 5 revolutions per second. Therefore, to make concrete a reply to your question, the length of time which would be required for the rod "b" of Sketch III and Sketch V, and corresponding to the rod "25" and "25a" in the patent drawing, will have gone from its normal position to the position where the maximum returning force is applied to the lever "b" within approximately 1-20 of a second.

Q. 143. Please suppose this condition: An extensive disturbance of the speed of the water wheel occurs, and an intense energization of the controlling solenoid takes place, which moves the core of the solenoid and then holds it effectively against returning movement under actuation of the rod "b" and friction clutches of the returning device, so that the slippage we have referred to occurs between the friction surfaces

of the returning device, and the governing action continues undisturbed or unaltered by the returning device and shaft No. 2 continues to rotate. When, now, under these conditions, will the returning device act through the rod "b" to move lever No. 1 and thereby move the core of the solenoid in a direction toward its normal position?

A. The maximum returning pressure, as I have before stated, will be reached within approximately 1-20 of a second. After that, slippage between the two discs will continue as long as the second shaft continues to rotate. During this period of continuance of rotation of the second shaft the torque produced by the slippage between the two discs will maintain rod "b" in the position to which it has been moved, thereby maintaining continuously the auxiliary returning pressure of the spring on rod "b" which co-acts with lever No. 1, and this pressure will be thus maintained until lever No. 1 does return to its normal position and thereby open the contact which closes the circuit through the magnet that actuates the friction returning device.

Q. 144. And when will lever No. 1 and the core of the solenoid connected with it be permitted so to move under the thrust of the rod "b" and respective spring between such rod "b" and lever No. 1?

A. When the speed of the turbine has been reduced to such a point that the voltage from the dynamo, the speed of which is also proportional to that of the turbine, has been brought down to a sufficiently low value, such that the pressure due to the spring of the returning device is slightly greater than the increase in magnetic pull above the normal value, this return of the lever will

take place. This is obvious from the fact that under normal conditions when the returning device is not acting on the lever, and when the voltage of the dynamo, and therefore the magnetic pull of the solenoid is normal, the solenoid pull is just balanced by the counter-balance spring. An increase in magnetic pull must be met by an increase in some opposed force, and must proceed from some source other than the counter-balance spring in order to cause return of lever No. 1 to its normal position, and this is accomplished by the pressure of the spring on rod "b" on the returning device. Therefore, in order to return the lever No. 1 to its normal position, the difference between the normal pull due to the solenoid and the changed pull due to the change in voltage across the terminals of the solenoid, must be slightly less than the pressure produced by the counter-balance spring, with due regard, of course, to the various lever arms through which these forces act, or, in other words, the moments of these several forces.

Q. 145. And is this relation between variation of solenoid energization and action of the returning device also true consequent upon a diminution of speed of the water wheels?

A. Yes. I attempted to make my answer to your previous question in regard to this general by using the word "change in" instead of "increased in."

Q. 146. And, when, with respect to the production of water-wheel-gate position with respect to that position proper in accordance with the new load indicated by change of speed of the water wheel, will occur this effectual action of the returning device, after its period of feeling-out, lever No. 1, and the core of the solenoid

accompanied by slippage of the discs of the friction clutch of the returning device?

A. The return of lever No. 1 to its normal position may in some cases coincide with the movement of the gate to its proper new position for change in load. In such case, however, this would happen only for some specific load variation and degree of opening of the gates at the time that governing might take place. Generally speaking, lever No. 1 will be returned to its normal position somewhat in advance of the time at which the gate of the turbine will reach the new position which is proper for and corresponds with the new value of the load.

Q. 147. And the gate will remain in that proper position for the new value of the load without departure therefrom to cause a governor-hunting or oscillating governor action? Is that correct?

A. Yes. There will be no force tending to cause the controller to move, and thereby cause movement of the governor to such a degree as will carry the opening of the water-wheel gates for increase in load, or closing for diminution of the load, past the point to which they should go. It is quite probable in many instances that the governor will not in one cycle move the gates completely and exactly to the points to which they should go, but will move them nearly to this position, and will take a second movement of comparatively short duration and extent to complete the final adjustment of the gates. But in no case will the gates be moved past the proper position to which they should go, assuming, of course, proper design and adjustment of the governor.

Q. 148. And in which of such sequence or steps of governing action does the returning device still act in a

restraining sense to prevent such overrunning of the governor and over-gate movement?

A. Always will the returning device act except in the extremely improbable case of less than 10 degrees of rotation of shaft No. 2, which, since it makes a complete rotation in one-fifth of a second, is hardly conceivable.

Q. 149. There are still certain parts of the previous question which I believe are not answered, namely, as to the dates upon which these five sketches of "Complainant's Exhibit Lyndon Early Construction Sketches and Identifying Affidavit" were made by you, and the circumstances under which such sketches were made by you. Please tell us about these points.

A. The dates are marked on the sketches and, as these were made by me personally and bear my initials and all the wording thereon is written in my handwriting, I know that the dates given on each of these sketches are correct.

Q. 150. Please state what those dates are, tying each date to the respective numbered sketch.

A. On Sketch I the date is April 21, 1899; on Sketch II the date is April 22, 1899; on Sketch III the date is marked "Rough May 30, present—" meaning the date of the actual sketch—"June 15, '99." These mean that the rough sketch was made on May 30, showing all these parts, and a cleaner and better proportioned sketch, made from the rough sketch, was made on June 15, 1899, which latter is the sketch here, marked Sketch III. Sketch IV has no date, and I am unable to assign any date to it, but I am sure it was made sometime after the sketches I, II and III, possibly as long as two months after that. Sketch V is dated June 28, '99. This sketch

I remember to have been the last one of a number of sketches which preceded it, in which previous sketches I was attempting to devise an arrangement whereby only one contact would be required to actuate both of the auxiliary magnets instead of a pair of contacts, one at either end of the lever carrying the main contacts, through which the main operating magnets were energized. I remember to have spent some time on this before I finally reached the construction shown in Sketch V, in which lever No. 2 has its right-hand side depressed, whether the solenoid moved upward or downward. The purpose of these sketches was to instruct the draughtsmen of the York Manufacturing Company, which company had agreed to undertake to develop the device commercially and obtain the United States patents, not only on the broad principles of the invention, but also on such details as might be developed in the course of bringing it to definite mechanical operating form, and to market the device in connection with a proposed output of water wheels.

Q. 151. What did you do with these sketches when they were completed?

A. I sent them to the York Manufacturing Company.

Q. 152. And how did you come to obtain them again?

A. On the request of Mr. Henry I wrote to the York Manufacturing Company asking them for such records as they might have preserved, showing the time at which we had entered into an agreement and the time at which they undertook to reduce this invention to commercial practice. And these drawings were returned to me by Mr. Shipley of the York Manufacturing Company.

Q. 153. And who made each one of these sketches, and every part and parcel thereof?

A. I did, personally.

Q. 154. This is the York Manufacturing Company, is it, with whom you have testified you took up the question of manufacturing the water-wheel governor in accordance with the invention of the patent in suit sometime about the first of the year 1899?

A. Yes, that same York Manufacturing Company.

Q. 155. Now, referring to the blueprints being part of "Complainant's Exhibit Lyndon-York Manufacturing Company Blueprints and Identifying Affidavit," and without going into details, what do these blueprints show?

A. One of these blueprints, the one marked "Electromechanical Water-Wheel Governor," is a diagrammatic representation of the various parts of the governor which was made to guide patent attorneys in taking out a patent which would cover all the features that are covered by the patent in suit. These were made for Mr. Bailey, while the patent in suit was taken out by Knight Brothers.

Q. 156. And, briefly, what do the other blueprints of this group disclose, without going into detail?

A. There is another blueprint which shows practically the same parts as shown in the blueprint labeled "Electro-Mechanical Water-Wheel Governor," but this second print omits the drawing of the turbine and the bypass valve and the electrical connections, and it is my understanding that this second-named print was first sent to Mr. Bailey and he required a fuller and more complete print, and that the one I have first described

was then prepared and sent him, in order that he might have all the data for the preparation of the patent. The print marked "Lyndon's Water-Wheel Governor No. 5852," is the assembly for an actual shop design for the manufacture of the governor. There have been in this print certain changes made in the method of actuating the by-pass valve and returning it slowly to its normal position, although the principles have been maintained the same as those originally proposed. Also, the blueprint labeled "General Design No. 2 of Lyndon Water-Wheel Governor, No. 5922," is another drawing for the reduction to practice of the features of my invention, but additional improvements in design have been made over the first-named shop design.

Q. 157. Now, did you furnish any other sketches to the York Manufacturing Company prior to the making of the blueprints just referred to and in addition to those of the "Lyndon Early Construction Sketches and Identifying Affidavit?"

A. Yes; I made a great number of sketches relating to the details of the device, and as the practical design of the machine took form new ideas would occur to me, not of the application of principle, or any change in the characteristics of the invention, but improved mechanical design which would tend to make the machine better in appearance, cheaper to manufacture, more easily adjusted in operation and, in some cases, to better fulfill the requirements of the conditions called for by the invention.

Q. 158. And what relation, if any, was there between such further sketches and the disclosures of these four blueprints of the exhibit we are discussing?

A. These further sketches were partly the outcome of the representations shown in these prints, and partly the outcome of more prolonged study of the actual mechanical requirements.

Q. 159. Do you mean that the sketches were the outcome of the blueprints, or that the blueprints preceding the sketches were in the hands of the York Manufacturing Company prior to the making of these blueprints?

A. No. I had not finished my answer. The first blueprints were made from and in accordance with a set of sketches I furnished the York Manufacturing Company. After studying these I made certain changes which I indicated by sketches, and from these came a second blueprint which is the first of the before-mentioned shop drawings. After studying this blueprint I made a third set of sketches improving on this first shop drawing, and sent these sketches to the York Manufacturing Company, and from this last set proceeded a second design called "Design No. 2," on the blueprints.

Q. 160. Then, as I understand it, all of these blueprints, as to their showing, were built upon disclosures to the York Manufacturing Company by you. Is that correct?

A. Yes.

Q. 161. How did you obtain these four blueprints?

A. These four blueprints in evidence here were obtained from the York Manufacturing Company sometime during the month of August, 1913.

Q. 162. And you obtained them from whom?

A. From the York Manufacturing Company.

Q. 163. Please, now, briefly compare the disclosures of the five sketches of "Complainant's Exhibit Lyn-

don Early Construction Sketches and Identifying Affidavit," with the disclosure of "Complainant's Exhibit A," a copy of the patent in suit, and in so doing, merely take the various groups of elements and features in each instance, and allocate them with the corresponding features and groups of the other, without going into any further description or general statement of operation.

A. Sketch I is a shop detail of the magnet which in the patent drawing is marked "15" and also "16," there being two of these magnets required for each machine. Sketch II shows the moving armature cooperating with these two magnets and marked "17" in the patent drawing. Sketch III shows a general assembly comprising the first shaft corresponding to shaft No. 6 in the patent drawing, "Main Drive Pulley" corresponding to gear numbered "5" in the patent drawing. A dynamo drive corresponding to the pulley numbered "7" in the patent drawing, ^{two} for beveled gears numbered "9" and "10" in the patent drawing, these meshing with a large bevel gear which is numbered "11" in the patent drawing. A longitudinal sliding member for clutching in either of the bevel gears, which is numbered "13" in the patent drawing. The lever "14" of the patent drawing, and the two springs, one on either side of the lever, which springs have no numbers, correspond with the magnet lever and springs which operate the sliding member before described and shown in Sketch III. The second shaft in Sketch III corresponds with the shaft numbered "12" in the patent drawing. The worm shown on the second shaft in Sketch III corresponds with the worm numbered "18" in the patent drawing. The friction-returning device shown in Sketch III and comprising a

magnet, a lever and two sliding discs, is shown in the patent drawing by the magnet "32", the lever "24", and the two sliding discs "22" and "23". The rod of the returning device lettered "b" in Sketch III is shown in the patent drawing and numbered "25a". The third shaft of Sketch III is shaft numbered "20" of the patent drawing. The lever and weight for returning the compensating-valve-actuating mechanism to its normal position is not present in the patent drawing, weights attached to a rope connection from the ^{lever}~~sleeve~~ wheel attached to the friction clutch being substituted in the patent drawing, which weights are numbered "70". The friction clutch for actuating this last-named mechanism, comprising a magnet, an operating lever and a sliding member constrained to rotate with the shaft which makes frictional contact with another member free on the shaft, are shown in the patent drawing, the magnets being numbered "64", the lever "61", and the friction clutch being numbered "57" and "58". The flange coupling of Sketch III corresponds with the bevel gear numbered "21" in the patent drawing.

Q. 164. Let me interrupt at this point and ask you in what sense you meant the application of the clutch disc "22" and "23" are slidably mounted in the drawing of the patent in suit in the comparison you have made?

A. I meant that one of these, the part marked "23", was keyed to the shaft, but could slide longitudinally along the shaft; part "22" was free to turn about the shaft, and when part "23" is slid along the shaft until it makes contact with part "22" and is pressed against it by the operation of the operating magnet, the part

"22" is then constrained to rotate within the limits of its ability to rotate with part "23".

Q. 165. And are both of the discs of the friction returning device in Sketch III slidably mounted, or how?

A. The disc "22" ^{being} ~~before~~ free to move in any direction on the shaft except in so far as it is restrained by collars or journal boxes against which the hub may press, is slidable within these limits, while the disc numbered "23" is also slidable within the ^{spring} ~~first~~ limit of operation, which limit is found in the travel of the armature from normal position to the face of the magnet toward which it is moved when the magnet is energized. In Sketch III the disc which corresponds to disc "23" in the patent drawing, is limited in its motion along the shaft by the limits of the operation of the lever by which this disc is moved longitudinally along the shaft; while the disc which corresponds to No. "22" in the patent drawing is prevented from sliding along the shaft when the first named disc is pressed against it by means of the collar fastened on the shaft behind this second-named disc. Sketch IV is a sketch of the weight meant to produce a force to return the compensating valve to its normal position, and corresponds to the weights marked "70" in the patent drawing. Sketch V shows a supporting spring marked "Spring No. 1" which corresponds to the supporting spring marked "37" in the patent drawing, and the solenoid shown in Sketch V corresponds to the solenoid "33" shown in the patent drawing. There is a soft iron core which operates in the solenoid and corresponds to the core marked "34" shown in the patent drawing. There is an operating rod attached to the solenoid core shown in Sketch V which cor-

responds with the extension of the core marked "35" in the patent drawing. There is a pivoted lever marked "Lever No. 1," in Sketch V and shown in the patent drawing and marked "26." There is a pivot about which this lever turns called "Pivot No. 1," in Sketch V, and marked "26a" in the patent drawing. There is a member to break contact at each end of the lever No. 1, marked "40" and "41" on the patent drawing. There is a connection between the operating rod and the lever No. 1 shown in Sketch V and shown in the patent drawing, being numbered "39." There is a rod which passes vertically up through the lever marked "b" in Sketch V and numbered "25" in the patent drawing. There are two springs on this rod, one being above and the other below the lever, as shown in Sketch V. These same two springs are shown in the patent drawing numbered respectively "27" and "28". There are two rough pencil indications of returning springs on rod "b" in Sketch V, which springs are also shown in the patent drawing, being numbered "29". There is a second lever called "Lever No. 2," shown in Sketch V, having a curved slot in one end and a make-and-break contact in the other end, and a bell-crank operating in the curved slot, which bell-crank is moved by the operating rod from the solenoid. These parts are all shown in the patent drawing, the lever being numbered "43", the slot numbered "44", the bell-crank numbered "42", and the single contact shown in Sketch V is increased to four contacts in the patent drawing, numbered "45", "46", "103" and "104". At the lower end of the operating rod is a spring which is in tension opposing the pull of the solenoid, and marked "Counter-

balance Spring" in Sketch V, which finds its counterpart in the patent drawing in number "38".

Q. 166. Aside from the release rod and lever No. 3 and the make-and-break contact device in Sketch V, are there any of the general features and elements disclosed in these five sketches which do not enter into the disclosure of "Complainant's Exhibit A," the patent in suit, with respect to general purpose and function?

A. No.

Q. 167. Please now compare the disclosure of "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketches of June and July, 1898," with the disclosure of "Complainant's Exhibit A," the patent in suit, by similarly allocating the several elements and groups of elements in that sketch with the counterpart features disclosed in the patent in suit.

A. There are shown in this sketch the turbine case, and projection therefrom; the main drive-shaft, which latter is not connected with anything, its mechanical connections with the other parts being understood to exist without any indication of this part in the sketch; the three bevel gears which mesh together; the clutch operated by the electro-magnets through the intervention of a lever and the pivot about which the lever turns; together with a short piece of shaft on which the two similar bevel gears and the clutch are mounted, are all shown. This short piece of shaft which corresponds to shaft numbered "6" of the patent drawing, is not shown as connected with anything else, and the method of driving it is not indicated, it being understood that any satisfactory means of causing continuous rotation would suffice. Also, the bevel gear corresponding to that one

shown in the patent drawing and numbered "11" is shown as being directly mounted on the gate shaft, it being usual in making rough, explanatory sketches to omit all well-known intervening mechanical devices when the novelty to be ^{found}~~discovered~~ resides only in the method by which a result is produced from the action of one device on some other device. The penstock leading into the turbine case, corresponding to the pipe marked "1" in the patent drawing, is shown. Also the by-pass pipe which is shown in the patent drawing and numbered "47". The by-pass valve is also indicated, which by-pass valve is shown in the patent drawing and numbered "48". There is the indication of a dashpot attached to the by-pass valve, its method of attachment and operation not being stated or indicated, it being understood that the dashpot would be connected in some well-known and approved manner, to prevent rapid return motion of the by-pass valve. This dashpot finds its counterpart in two dashpots numbered "69", as shown in the patent drawing. The shunt-wound dynamo, indicated by the word "Armature", supplying current to the controlling solenoid and corresponding to similar parts in the patent drawing, are shown in the sketch. Also the oscillating lever in the sketch corresponds to the lever numbered "26" in the patent drawing, and the two main contacts of this lever by which electrical connection is established from a source of electrical energy through the main operating magnets and corresponding to contacts "40" and "41" of the patent drawing, are also shown in the sketch. The suspension spring of the solenoid corresponding to the spring "37" of the patent drawing, is not shown in the sketch, it being intended that a usual

and standard method of supporting the solenoid core would be used. One auxiliary contact is shown on the oscillating lever, which contact is meant to produce electrical connection from a source of current supplied through a magnet winding to operate the friction returning device, which corresponds with the parts shown in the patent drawing and numbered "22", "23", "24" and "32". The rod of the returning device, corresponding to the part shown in the patent drawing and numbered "25" and "25a", bearing springs at the upper end of this rod, corresponding to springs "27" and "28" in the patent drawing, are also shown. The springs for returning this rod to its normal position and with it the disc to which it is attached, shows in the patent drawing and numbered "29", are omitted from the sketch, it being understood that some well-known method of returning the rod and disc to normal position would be used. The counter-balance spring shown in the patent drawing and numbered "38" is also shown in the sketch. The means of operating the by-pass valve which are disclosed and indicated in the patent drawing, are not shown in the sketch further than the mere statement "inverse connection", it being understood that as the gate-shaft would rotate in either direction the by-pass valve could be made likewise to rotate in either direction, and it would be merely a matter of mechanical connection to make the closing of the water-wheel gates inverse to the opening of the by-pass valve.

Q. 168. Are there any of the general elements, features and inter-relations disclosed in this sketch which are not found in counterpart in the disclosure of "Complainant's Exhibit A," the patent in suit?

A. No. Everything shown in that sketch is included in the drawing of the patent in suit, so far as the representation of the parts in the sketch applies to the principles and methods involved.

Q. 169. I notice that in this sketch you show two sources of electrical energy, one being the conventional showing in circuit with the oscillating lever actuated by the solenoid core for operating the several magnets of the controlling system, and a circuit electrically supplied by the generator, and in which circuit the controlling is included. How does this provision of sources of electrical energy in the sketch compare with the provision of those in the patent in suit?

A. The patent in suit provides only one source of electrical energy, which is the controlling dynamo. It was never my intention to use two sources of electrical energy, but it is customary in making sketches to simply use at some convenient point an indication of a course of electrical energy that may be convenient, so as not to confuse the sketch with the indication of too many circuits. That, therefore, simply means that electrical energy from any convenient source may be used, though, obviously, the most convenient source would be from the generator which is an inherent part of the governing mechanism.

Q. 170. Please sketch now further the development of your dealings with the York Manufacturing Company, which commenced, as you say, about the first of 1899, with relation to the governor, being the subject of the patent in suit.

A. Would it be proper for me to read over the correspondence or copies of correspondence from the York

Manufacturing Company to refreshen my memory, and thereby make briefer the statements I may have to make?

Q. 171. You have vouched for these letters, and there is no objection to your referring to them, they being in evidence, if you wish to, and you may do so, but I wish more particularly to have you briefly outline the progress of your negotiations with the York Manufacturing Company and what was the eventuation of these dealings, mentioning times and names or persons involved. If you wish to specify any particulars, you may refer to the exhibit mentioned.

A. I first took up the matter with the New York representative of the York Manufacturing Company, who was also in charge of all exports of this company, Mr. David S. Hays. I had not been in the New York ~~office~~ ^{office} of the American Trading Company any considerable length of time, and I was extremely busy with my normal duties as chief engineer of that company, and all negotiations with Mr. Hays which took the form of interviews at opportune times necessarily occupied more time than they would have if I had been free to give all of my time to such negotiations. After talking over the matter with Mr. Hays on several occasions, he decided to bring it to the attention of his principals at York, which he accordingly did. After the lapse of some time, the length of which I am ^{not} now able to state, Mr. Shipley came to New York and we discussed the subject further. Mr. Shipley expressed himself as approving the idea, and said that they would undertake to develop this invention, put it on the market under certain conditions, and, after some further correspondence, this work of development was actually begun. I made a number of

sketches and sent them to them and after considerable time finally got a drawing from them, or, rather, a blueprint, after which I made other sketches and sent them to the York Manufacturing Company, and these sketches resulted in other blueprints, which process was repeated possibly three or four times. At about this period the York Manufacturing Company was extending its business considerably, and, according to the representations of Mr. Shipley to me, the draughting room of his company was over-crowded with work and for a considerable length of time he was obliged to set aside this development of the water-wheel governor until the rush of work in the draughting room could be handled and disposed of, and arrangements made to again take up and carry on the work of designing from the point it had reached at the time he was obliged to cease work on it. I assented to these conditions, and it was not until near the end of 1899 that the final assembly drawing which we considered satisfactory was produced. My memory is that between eight and ten months had been consumed between the time which elapsed from the beginning of work in the draughting room of the York Manufacturing Company and the completion of this last design, which is shown in one of the blueprints that form part of the exhibit in this case, and which is labeled "Design No. 2." I do not know how far the York Manufacturing Company proceeded after that time with the detail drawings of the various parts, but some time after the final drawing before referred to was made, the York Manufacturing Company for reasons which I have elsewhere explained decided not to engage in the manufacture of any hydraulic machinery. I consented to release

the company from its agreement with me, and something like a year or more after I had first opened up the subject with them this agreement was abrogated and was without any progress toward the development and marketing of this machine, except that which had been made in the draughting room of the York Manufacturing Company. Also, in the early part of 1899, the York Manufacturing Company, in accordance with its agreement with me, sent drawings to Marcellus Bailey, Patent Attorney in Washington, with instructions to prepare patent specifications and claims covering this invention, and from the knowledge which I have been able to obtain, Mr. Bailey laid this matter aside until he felt that it would be opportune, and he had ample leisure to handle it. My memory further is that I went to Mr. Bailey's office in the spring of 1900 and finally got from him such papers as he had that bore on the subject, and during that same year turned them over to Knight Brothers for the purpose of obtaining a patent, and the obtaining of the papers from Bailey's office finally closed the relations I had with the York Manufacturing Company in connection with this invention, until in 1913 I requested them to give me such copies of such letters as they had which passed between us and referred to it, and such other documents and data as would assist in establishing the date of the agreement between us and the beginning of their work in its development, which request I made of them sometime during the summer of 1913.

Q. 172. As to the papers which you obtained from the patent attorney Bailey and took over to Knight Brothers in New York, do you know where they are now?

A. I have no idea, unless Knight Brothers have kept

such documents in their files, and it is quite probable that they have not done so, not only because of the period of time which has elapsed, but also, because Knight Brothers moved their offices from No. 20 Broad Street to No. 2 Rector Street, and undoubtedly went through the usual process of clearing out a large number of old and apparently useless papers at that time. I have never asked Knight Brothers whether they still possessed these original documents or not.

Q. 173. Are you prepared to state whether there was a written agreement entered into between yourself and the York Manufacturing Company concerning the proposals for manufacture which you have been testifying about?

A. I do not now remember. I am inclined to think that any agreement that we had was in the form of a letter from me to them and a reply from them to me in which they assented to the proposal that I had made in my letter. I seriously doubt whether either of us would have proceeded on a mere verbal agreement, but I, at this time, have no recollection of the agreement nor what its terms of compensation to me were to be. I only recall that the York Manufacturing Company undertook to commercially develop and to patent this invention.

Q. 174. Please now state what, if any, further efforts you made in connection with the introduction or exploitation of the invention of the patent in suit after you placed the matter of patenting this invention in the hands of Knight Brothers.

A. In the early part of 1900 I left the American Trading Company and went to Baltimore, where I remained until about October of that year. During this

time I brought the invention to the attention of several individuals and manufacturers in the hope of getting them to manufacture the device on a royalty basis, but did not succeed in interesting any of them. In 1901 I returned to New York and persisted in the effort to make some disposition of the invention. In the summer of 1901 I was retained by the National Battery Company, and the work of this company took me to Buffalo, New York, frequently. During several of my visits to Buffalo I attempted to interest parties there, notably Mr. Burtis, who was president of the Howard Iron Works, and at one time Mr. Burtis accompanied ~~me~~ to Niagra Falls and introduced me to the engineer of one of the power companies near Niagara Falls and whose name I at this time have forgotten. This engineer approved the method of governing which I had developed, and said that he would purchase one governor on trial, and we made a tentative arrangement for supplying one of these machines, it being the intention to have the Howard Iron Works build it. I made some further sketches to reinforce such drawings as I had already made, and tried to induce Mr. Burtis to go ahead with the work of building one. He kept deferring the matter, and the engineer to whom I had agreed to supply it could not wait an indefinite period of time for the machine, and, therefore, withdrew from his original promise to purchase one. I spent considerable time in such efforts, and, among, others, approached Mr. John Bogart in New York, who expressed himself favorably concerning the machine, but said that he could not do anything toward having it manufactured, although as an engineer, he would be glad to obtain such machines for the government of water wheels in water

powers that he was then acting as engineer for. I made continuous efforts in every available direction, it being my desire to have the machines manufactured and sold, and a royalty to be paid to me on each machine, as I did not desire to sell the patent. About 1904 I interested William Ross of New York, who at that time was engaged in manufacturing and marketing automatic stokers for boilers. Mr. Ross at this time was having his stokers built by the Kutztown Foundry & Machine Works of Kutztown, Pennsylvania, of which Mr. Irvin Bair was general manager. Mr. Ross and myself, after some negotiations, reached an agreement, and under this agreement complete shop drawings were made for a governor, and construction work begun in the works of the Kutztown Foundry & Machine Works. Most of the parts of this machine were completed, and a controller was built by the Ball Electric Company of New York. About the time that the parts of this machine were finished, Mr. Ross and the Kutztown Foundry & Machine Works had a disagreement about the payments which were due to the latter company by Ross for stokers which they had supplied him. Due to this disagreement, the Kutztown people declined to finish the governor and also declined to let Mr. Ross have the parts so that we could finish it. And, so far as I know, the parts for that machine are still in Kutztown. This new negotiation and final failure consumed about a year, if my memory is correct. Subsequent to the final cessation of any relations between Ross and myself which, I should say, occurred in the latter part of 1905 or the early part of 1906, I began offering this patent for sale to various manufacturers of water-wheel governors, having by that

time practically given up the idea of getting any manufacturer to undertake to build and market it on a royalty basis. Among others, I carried on some negotiations with the I. P. Morris Company of Philadelphia. Just about that time I discovered that the Allis-Chalmers Company had infringed my patent in the application of the by-pass valve, operating under the conditions of my invention to a governor which they supplied to the Great Northern Power Company, at or near Duluth, Minnesota. I brought the attention of the company to this infringement and made an effort to get them to settle for the infringement and to purchase the patent, but without success. I, of course, realized the impossibility of my successfully contending with the Allis-Chalmers Company in court, as I knew enough about patent suits to know that it is unwise to embark in one, unless the litigants have both the time and money to carry it to a successful issue, and, as I had neither, I brought no suit against them, although I made a number of efforts to induce them to make a settlement and to purchase the patent. I also discovered that the Pelton Water-Wheel Company were infringing this patent, and I had two or three interviews with the New York representative of this company, Mr. Kunze, and the only result of these interviews was a flat declaration that the Pelton Company did not infringe my patent. I have never missed a opportunity to bring this to the attention of a possible purchaser, and there is not a manufacturer of water-wheel governors in America that has not had this patent brought to his attention by me for the purpose of either making an arrangement to have it made on a royalty basis, or a sale of the patent.

Q. 175. Machines embodying the invention of the patent in suit are expensive to manufacture, are they not?

A. They are expensive to manufacture, expensive to sell, and cannot be successfully made and sold, so far as financial returns are concerned, without a considerable capital and a well-organized factory staff and a complete and thoroughly able selling organization.

Q. 176. And such machines or apparatus are usually built upon specifications which vary, do they, with respect to the particular requirements of the installation to include the same, such as to the power available, and such like?

A. Yes. There are comparatively few water-wheel governors of any size or importance that are absolutely standard stock machines. While a large number of the parts which enter into the make-up of a governor may be made of a fixed design, there are usually special conditions that have to be met for each installation of water wheels.

Q. 177. And have you at any time since creating this invention of the patent in suit been in a position, because of manufacturing facilities, or the financing of such manufacturing enterprise, to manufacture and supply properly governors embodying your said invention to the general field of this invention?

A. No. I have been continuously engaged in professional work since the latter part of 1900, and it has taken practically my entire time to derive a sufficient revenue from that to meet my needs; and, even if I had a small amount of money to invest, it would have been impossible for me to give my time to the work. I had neither

the money nor the time to give to it, and it was an utterly unthinkable thing that a man whose time was totally occupied and who was without funds should attempt to embark in any such enterprise as the manufacture and sale of water-wheel governors.

Q. 178. And during all the period of time since you made this invention you have had more or less occasion to travel about the world in connection with your engineering business?

A. Yes.

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Q. 179. In addition to your practical work in the practice of your engineering profession, including your work in the field of which you have told us, have you written any treatises, articles, or the like, pertaining to engineering subjects for publication? If so, please state by what means the same were published, and the approximate dates of publication.

A. Yes; I have written several articles, books and monographs on technical and scientific subjects. The most important ones which I now remember are on the "Design of Tractive Electro-magnets," which was published in *The Electrical World* about 1900; a series of articles on "Electrical Systems of Distribution," which appeared in *The Electrical World* in 1901; a series of articles entitled "Physical Conceptions of Alternating Current Phenomena," which appeared in *The Electrical World* in 1904; a paper presented before the American Institute of Electrical Engineers on "Comparisons of the Behavior of Floating and Booster Controlled Storage Batteries under Fluctuating Loads," presented in 1902; a paper before the American Institute of Electrical

Engineers on "A New Method of Turbine Speed Control," the date of which is 1906, as determined by reference to a copy of the publication; a paper before the American Institute of Electrical Engineers on "The Corona and its Effect on Design of High Tension Transmission Lines," presented in 1906. The books I have written are "Storage Battery Engineering," which work has been translated into French and has for the past ten years been the standard in the English language on the subject of the storage battery, and its engineering applications. I understand from the publishers that it is used as a standard and text-book in about twelve American Universities, by the United States War Colleges, by the technical corps of the United ^{States} Army and Navy. It has never taken the same rank in France, and I am informed that the reason for this is that it deals almost entirely with American practice. Another book is entitled "The Development and Electrical Distribution of Water Power," which, I understand is regarded as one of the standard works on this subject. That was published, I believe, in 1907 by John Wiley & Sons, of New York. I also wrote two sections for "Foster's Electrical Engineers' Handbook," the two being the sections on the storage battery and that of "Resonance in Alternating Current Circuits." I also edited the section on Electricity and Magnetism for the "New Editor's Encyclopedia," and I collaborated in writing the section on "Traction" in the new edition of the Encyclopedia Britannica.

Q. 180. Have you had occasion in your experience to deal with water supplies from varying sources and

of varying descriptions and nature in connection with hydro-electric unit installations?

A. Yes.

Q. 181. I now show you "Complainant's Exhibit Bottle of Kern River Water at Power Development Company Plant," and I will ask you to inspect the same optically and state whether you find the same to have any content of finely divided stone, schist or like material.

Mr. Westall: The question is objected to on the ground that the witness has not been qualified to testify as an expert respecting the various kinds of water that flow in the various rivers which are used to propel water wheels, and that the question calls for expert evidence as to the condition of water, which is not within the issues of the present case.

A. There is nothing visible in this sample of water submitted for inspection that is either hard or has a specific gravity that in any wise would approach that of sand, schist or other stony substances. The water appears to be clear, with the exception of a few deposits of a flocculent material which sinks very slowly through the water, and appears, a portion of it, to float, remaining in whatever position it happens to have been put, thus indicating that the specific gravity is approximately that of the water itself. If this sample is a true sample of the water of the stream from which it was taken, it represents the best condition that I have personally ever encountered, so far as wear or abrasive action on water wheels or parts of hydraulic machinery through which this water may pass, is concerned.

Q. 182. By Mr. Blakeslee: In your numerous references during your testimony to the patent in suit, "Com-

plainant's Exhibit A," as, for instance, in comparing with the disclosure of the same disclosure of "Complainant's Exhibit Lyndon Reproduction Sketch of His Disclosure Sketches of June and July, 1898," and in similarly comparing with the same the sketches of "Complainant's Exhibit Lyndon Early Construction Sketches and Identifying Affidavit," you have pointed out the several main elements and groups of inter-related elements of that embodiment of your invention which you commenced to build up and organize, more particularly from the date of the disclosure to Mr. Meyer before the first of August, 1898; and have particularly set forth as the main framework of such construction the water-wheel gate or gates, the pipes and by-pass and by-pass valve, the means of producing slow closing or returning movement of the by-pass valve, the speed-sensitive device, the means responsive to the action of the speed-sensitive device for inversely actuating the water-wheel gate or gates and the by-pass valve, and the returning device for affecting the operation of said last means, to prevent over-running of the governor or to bring the water-wheel gate or gates to its or their proper position for a change in speed of the water wheel, and to hold the same at that point. You have likewise referred to various electrical and electromagnetic devices and features, such as circuit wires, contact devices, solenoids and the like, as incorporated in the general system, including the mechanical features or mechanically performing features above mentioned, as constituting the general framework of the embodiment of the invention. Will you please state why, in the working out of such embodiment of the invention, you resorted to the use of such

electrical and electromagnetic devices for the transmission of energy, and the setting into operation of mechanically working features, instead of having recourse to purely mechanical features in these respects?

Mr. Westall: Counsel for defendant objects to counsel testifying and dictating a deposition in the form of a question. The question obviously endeavors to construe the previous testimony given by the witness to describe certain functions and relations which are not to be found in the previous testimony of the witness, and are conclusions of counsel based rather upon what he would like to have the record show than upon what it actually does show. There is a lack of connection between the long statement of the first part of the question and the question proper, which makes this attempt very obvious. Also, that the question is irrelevant, immaterial, incompetent and not proper rebuttal testimony.

Mr. Blakslee: We call again the attention of the Examiner to Equity Rule 51, and require that he comply with the provisions of such rule with respect to argumentative and high-sounding alleged objections just put on the record. The question speaks for itself with respect to the record in this case, and that is all there is to be said in response to the alleged objection.

A. As I understand the question, it is desired to know why I adopted electrical means for effecting the functions and producing the mechanical performance of the various objects which I desired to attain, through electromagnetic means. My answer to this is that I believed, and still believe, that the use of a solenoid with a variable voltage and variable speed under-saturated dynamo is the most sensitive controlling device that can be pro-

duced. Starting with this, it followed logically that the other portions of the governor would be made to be actuated electromagnetically, and energy would be conveyed, therefore, over wires from point to point of the machine rather than by any other means. Furthermore, my state of mind was at that time almost entirely electrical and magnetic, so far as any industrial or scientific applications were concerned. I had been more deeply interested in the study of electricity and electro-magnetics than any other scientific study, and had persistently followed this, almost to the exclusion of any other branch of the industrial arts. It therefore was logical that I should have adopted electrical energy and the usual means for transmitting this energy from one point to another throughout the machine, rather than other forms of energy for the corresponding methods of transmitting these other forms to the different portions of the device.

Q. 183. By Mr. Blakeslee: In any instance, entering into the embodiment of the invention of the patent in suit, as set forth in the specifications and drawings of said patent, is there lacking a distinct mechanical action in the performance of the intended function, although the respective feature be set into play electrically or electromagnetically?

Mr. Westall: Objected to on the ground that the patent speaks for itself as to what it contains and what it lacks, and that the question is otherwise incompetent, irrelevant, immaterial, and not proper rebuttal.

Mr. Blakeslee: We point out in this connection that the testimony of this present witness with respect to the nature of this invention which he has created is

most competent, and we further point out that we are desirous of showing the court, because of the attempts by the defendant to show the contrary, the specific, simple, direct and unfailing action of the construction disclosed in the patent in suit.

A. The fact that in its final analysis this governor is a machine, indicates that there can be no mechanical element lacking. If there were, it would be an incomplete and inoperative device. The portions of the machine are caused to act in accordance with changes in speed or other external conditions, by means of energy which simply, according to my own personal preference, takes the form of electrical energy, but this in no wise differentiates it from any other machine the parts of which are caused to act by any convenient or available form of energy.

Mr. Westall: I move that the answer be stricken out on the ground that it is argumentative.

Q. 184. By Mr. Blakeslee: Please compare briefly the transmission by electricity or by an electrical path, including an electrical magnet, with purely mechanical transmission, with respect to positiveness and effectiveness and quickness.

Mr. Westall: Objected to as vague and indefinite, and also on the ground that it is incompetent, irrelevant, immaterial and not proper rebuttal. The issues do not in any wise concern electrical transmission, but rather the various devices and means by which certain results might be obtained.

Mr. Blakeslee: In other words, as we understand the objection, a transmission may be considered mechanical

or anything else, although the disclosure is with respect to what apparently are electrical paths.

A. I believe that there are mechanical means which are as positive and effective as electrical means for transmitting controlling energy from one point to another in water-wheel governing. Also, the final action of a strictly mechanical, as opposed to an electro-mechanical governor, should give an operation within practically the same time-space. I believe that electro-mechanical devices can be arranged more conveniently and more cheaply and can be better adjusted than strictly mechanical devices where varying and intermittent action of the machine may be required.

Q. 185. By Mr. Blakeslee: And in a long and devious path of transmission, what have you to say with respect to the lost motion entering into mechanical transmission as affecting the positiveness of such train, in comparison with the positiveness of action through an electrical path?

A. In case of a strictly mechanical connection for the transmission of energy, where the direction of transmission is changed, there will be lost motion, and, therefore, a comparatively different character of mechanical transmission, except when the workmanship is of a high order, and during that period of the life of the machine when wear on the parts has not reduced the efficiency of transmission. In a case where the workmanship of a strictly mechanical transmission is not of the best, or where there has been considerable wear of the parts, even though they at first were well made, mechanical operation of any machine which depends on the maintenance of the exact relations of these parts is neces-

sarily less exact than in the case of electrical transmission in which the character of the transmission is not affected either by workmanship or wear.

Q. 186. Then, with respect to a governor performing functions of that disclosed in the patent in suit, what would be your preference in constructing such a governor, and even with extensive departures from the specific construction and arrangement shown in the drawings of the patent in suit, when it came to the question purely of energy transmission for setting into motion various mechanical working features of the construction?

A. My preference would be in favor of electrical transmission, not only for the reasons before given, but also because of its low cost and the ability to make changes in the direction of the impulses without changing the mechanical adjustments and parts of the machine.

Q. 187. That is to say, if I understand you correctly, that the machine is more adaptable, and, we may say, flexible, and responsive to varying conditions of service with the use of electrical transmission, inasmuch as inexpensive and light wearing and electromagnetic elements may be used, shifted or adjusted as desired or required, thus obviating the manipulation and adjustment of heavy mechanical transmission devices, such as shafting, couplings, counter-shafting, belting and the like. Is that correct?

Mr. Westall: Objected to as leading and argumentative, and as an attempt on the part of counsel to testify as an expert, without being sworn, and as an attempt to piece out the testimony of the expert with what he would

prefer that the witness say rather than what the witness is actually stating.

Q. 188. By Mr. Blakeslee: We will ask the witness now to say in these respects.

A. My preference would be for electrical transmission, not only for all the reasons which have been cited, but, furthermore, because the electromagnetic means to which the energy is transmitted, are also not subject to wear, and the forces acting remain in constant adjustment, regardless of the length of time that the machine may be in use.

Q. 189. In your previous testimony and in the disclosure of the patent in suit reference is made to a device sensitive to changes in speed of the water wheel, being in the patent disclosure the dynamo "8". Please define what is, and at the time of your invention of the subject of the patent in suit was your conception of such a proper speed-sensitive device for setting into operation the controller of the governor so as to obtain the most sensitive, positive and efficient governing action?

A. At first when I undertook to solve the problem of water-wheel government, I had in mind the use of a mechanical inertia governor. But the idea of using the speed-sensitive electrical device which occurred to me and which is as disclosed in the patent in suit, seemed to give a more sensitive method of control and one in which the elements of workmanship and wear would be practically eliminated, and the adjustment once made would be permanent. This control comprises the use of a small dynamo driven from the turbine, the speed of which latter is to be regulated, and, therefore, the speed of this controlling dynamo will vary in exact pro-

portion to any variation in the speed of the water-wheel driving it. The change in speed produces a change in voltage, due to the change in speed, and this voltage itself reacts on the dynamo, which is shunt-wound, to change the field excitation, which, again, influences the voltage of the armature in accordance with the well-known laws of electro-magnetism. The percentage of change in voltage will in every case be much greater than the percentage of change in the speed of the source from which it is driven. I have previously described an arrangement of a solenoid winding, in which works a soft iron core. The pull of any electromagnetic device varies directly as the square of the magnetic density, and the magnetic density in the case of an iron core where the normal density is not very high, will vary substantially directly with the current which passes through the windings of the solenoid. Since the resistance of the solenoid remains constant after it has once attained its normal temperature, it is obvious that the current through it will vary directly and in accordance with the applied voltage. By transmitting electrical energy from the controlling dynamo to the terminals of the solenoid, the following conditions of any speed change of the turbine driving the controlling dynamo results: For a given speed change, a considerably greater voltage change, for a given voltage change, a considerably greater change in the pull of the solenoid than change in the voltage; if the magnetic densities in the controlling dynamo and in the solenoid core are kept low, the pull on the solenoid core will vary approximately as the fourth power of the dynamo speed. In a mechanical governor the change in the force which it applies to operate any mechanism at-

tached to it, varies about as the square of the speed. From this it follows that the electromagnetic speed-changing device which I invented, and which forms a portion of the subject of the patent here in suit, has a much greater sensitiveness than that attainable with any known form of mechanical governor.

Q. 190. Will the speed-sensitive device of your invention of the patent in suit respond to any other change of condition in the water wheel and generator, or other power consumer driven thereby, than a change in speed of the water wheel?

A. The speed-sensitive device itself does not respond to any condition other than speed change. By the arrangement of the governor mechanism, whenever a speed change of the prime mover is attended by a change in the gate opening, the mechanism which sets the gates in motion is arranged to also apply another and extraneous force to the speed-sensitive device for the purposes which have before been set forth and are described in the patent, and this extraneous force is only added to the other forces acting on the speed-sensitive device when motion of the gate-shaft takes place.

Q. 191. In governing action does the speed-sensitive device of the invention of your patent in suit take into account any changed condition occurring with respect to the water wheel and the parts driven thereby, which cannot be, and, in fact, is not directly expressed in terms of speed-change, or, in other words, respond to any other changed conditions?

A. The speed-changing device of my invention does not respond to any change in the condition of the prime mover except change in speed, except so far as this

change in the forces acting on the speed-changing device is checked by the extraneous force set up by the machine itself, which machine is, in turn, controlled by the speed-changing device.

Q. 192. What are these extraneous forces and the object and effect of the same?

A. If the speed-changing device had no forces acting on it except the electromagnetic force, which varies in its density with speed-change of the prime mover by reason of the intermediary action of the variable-voltage controlling dynamo, the operation of the gate-moving mechanism would have to continue until the speed of the water-wheel which had departed from normal, before the mechanism began to move, had returned to normal. In the case of the arrangement whereby the gates of the water wheel would be moved very rapidly, the space of time required for the water wheel to return to its normal speed would be such that within that same time the travel of the gates would have proceeded to a point beyond the proper value, such that the gate opening would be suitable for the change in load which produced the departure from normal. In order to make this clear, consider an increase in water-wheel speed due to a diminution in load. There is some proper gate opening which is less than the gate opening that existed at the time of the change in load, and which new condition of lesser gate opening corresponds exactly with the load on the water wheel. When the water-wheel gate has moved as far as this point, it should proceed no further. If it does, the gate opening is so far reduced that the speed of the water wheel will not only return from the first condition of excessive speed to normal, but will be further

reduced below the normal speed. This so-called over-running of the water-wheel gates must be prevented by some means, for otherwise, with a change in load, the governor can never bring the water wheel back to its normal speed, but will continue to "hunt" back and forth, closing the gate to diminish the speed, and closing it too far, so that the speed is diminished below normal, and then opening the gate to increase the speed to normal and moving the gate too far in the direction to open them so that the speed increases to normal and goes past normal, when the cycle is again repeated. I have personally witnessed this operation in water-wheel governors and have seen it continue for several minutes until finally corrected by manual action on some part of the governor to arrest its motion. With this explanation, the object of the device for overrunning becomes clear. When the speed of the water wheel increases, the pull on the controlling electro-magnet, corresponding to the increase, causes the contacts to be made whereby the mechanism is set in motion to close the water-wheel gates. As soon as all the parts of the machine are set in motion, the overrunning device acts practically instantaneously, and its action consists in building a force which opposes that first produced by the change in solenoid pull. Therefore, the electro-magnetic controlling device is constrained to return to its normal position prior to the time when the water wheel has returned to its normal speed. When the controlling device returns to its normal position, the operation of the governor acting on the water-wheel gates ceases. If within the interval of time which elapses between the opening of the contacts when the controlling device is returned to its normal position

and actual return of the device to its absolutely neutral position, the speed of the water wheel has reached normal, due to the fact that the water-wheel gates were, in this first operation, moved to substantially the proper degree of gate-opening for a change of load, the operation of the machine is finished, neglecting, of course, any slow return of the by-pass valve. If, however, the friction returning device for preventing over-running has caused the controlling device to return to normal position and break the electrical contacts before the water-wheel gate has reached its proper position suitable for the change of load, then the still unbalanced electro-magnetic pull on the solenoid will cause the contacts to again be made, motion in the same direction as before to still further open the water-wheel gates begins, and instantly the counter-acting force of the over-running device is brought into play and the cycle first described repeated, except that its duration would naturally extend over a very much shorter time, because the water-wheel gates have within the period of the first operation approached more nearly to normal speed, and the unbalanced force acting at the beginning of the second cycle on the electromagnetic controller would be less than during the first, and any force set up by the over-running device would return the controller to its normal position, breaking the contacts almost as soon as the overrunning device would begin to exert its counter-acting force on the controller. It might be that after this second cycle, the water-wheel gate would not quite have reached its final position, and there might be a third motion of the controller, the machine, the over-running device, and the water-wheel gate, which for the same rea-

son before given would endure for a much shorter time than the second cycle. From this it follows that, in general, the operation would be, first, a considerable movement of the water-wheel gates toward the point to which they should be moved for a new load, then and immediately succeeding, a shorter distance of motion of the gates, and then another still shorter motion, so that movement would practically take place in accordance with the curve of speed-change variation.

Q. 193. In your last answer you have referred to "load" in connection with changes of speed on the water-wheel gate. What bearing is there of one upon the other?

A. Assuming a constant head of water acting on the water wheel and the preservation of a constant speed on the water wheel, there is a specific and definite degree of gate-opening, which corresponds to a specific and definite load. Any change in this load must be accompanied by change in gate-opening if the speed is to be preserved substantially constant.

Q. 194 May there be changes of load irrespective of changes of speed, and vice versa, in a given hydro-electric generating plant?

A. Not if the head and the gate-opening are preserved constant. If the head is constant and the gate-opening fixed at a certain value, and the load on the water wheel is changed, there will be a change of speed. Conversely, if the load be preserved constant and the same head and same gate-opening be preserved, there would be no change in speed.

Q. 195. Let us assume that there be variation in

these respects as between gate-opening and head, on the one hand, and load on the other. May there then be differences or disproportions as between speed and load?

A. In order to make the conditions general, the quantity of working fluid multiplied by the unit energy in the working fluid, must be equal to the energy supplied to the load, and any change in either the quantity of working fluid or the energy per unit of working fluid for a given load, will produce a change in speed. In fact, any change in any one of the three factors will produce a speed change. Therefore, if the load be constant, the gate-opening constant, and a change in head takes place, the speed will change. If the head be constant, the load be constant, and the gate-opening be changed, the speed will be changed. If the head and gate-opening be constant and the load be changed, there will be change in speed. But unless some one of these three elements be changed, there will be no change in speed.

Q. 196. Let us assume that the load increases and the head proportionately increases, and the gate-opening remains constant. What will be the result upon the speed factor?

A. There will then be no change in speed. In every case the relationship comes back to the quantity of working fluid multiplied by the energy per unit volume as being equal to the energy delivered to the load. If two of the opposing factors are changed, and changed proportionately, the third being constant, there will be no change in speed.

Q. 197. Now, let it be assumed that under the conditions last recited, the water wheel in question

is governed by a device responsive to change of load. Would or would not a governing action occur when the load was increased and the head proportionately increased?

A. If the governing device be responsive strictly to changes in load, the water-wheel gate would be moved to a new position for every load change, regardless of whether or not there had been any change in any of the other factors. And, no matter how much the head might increase or decrease, or however much change of head might keep pace with the change of load, the governor would always move the gates whenever a change in load would occur if it be actuated by a device responsive to changes in load.

Q. 198. And such change of gate position responsive to such governor, in turn responsive to variations in load, would produce a change in speed of the water wheel. Is that correct?

A. If the head should remain constant and the governor be a well-designed machine, there would not be a substantial change in speed any more than with any other governor. But if there were a variation in head and the controller were responsive strictly to change in load, then there would be a gate movement for change in load, even though there had been a compensating condition of change in head, which means that a governor built on these lines would have a different speed for every difference in head.

Q. 199. And what would be the results in these respects as to maintaining proper speed of the wheel?

A. It could not maintain proper speed of the wheel unless newly adjusted for every change in head, and it furthermore would have the added disadvantage of a change in relationship of parts for change in load, which, carried to its last analysis, means a change in the velocity of the device which is driven by the water wheel, whether a line-shaft or a dynamo, through a portion of one cycle of revolution. This is a condition which could not be permitted in the driving of alternating current generators, nor driving the machinery of that class which depends for uniformity on the successful production of the commodity being manufactured, such as textile machinery.

Q. 200. Now, let us assume the provision of a governor designed to be responsive to changes in both speed and load, and assume that the controlling portion of this governor element is directly installed between the water wheel and the driven machinery, as an electrical generator, what would be the nature of the controlling action of this device with respect to the speed of the driven machinery where load increases and head increases at the same moment, the gate opening being constant?

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Q. 201. By Mr. Blakeslee: And where the power-consumer driven by the water wheel is an electric generator, what would be the effect upon the potential of the current generated?

A. In case of constant generator excitation, or for a self-excited generator, the potential would increase with speed increase.

Q. 202. And what would be the result upon the speed operation of an electrical energy consumer supplied by such circuit?

A. Under normal conditions of electrical distribution such an electrical-energy-using device would absorb more electrical energy than it had been receiving prior to the increase in voltage.

Q. 203. And were a governor possible for the machinery being driven upon this circuit, what would be the effect produced upon its rate of action?

A. An increase in speed, whether alternating current or direct current, except in the one case of under-saturated direct current motors. In these the application of an increased potential to the armature brushes and an increased potential to the field winding, within certain limits, would result simply in maintenance of constant speed. But these latter kinds of machines are so unusual that it may be stated that, in general, the speed of any electric motor will be increased.

Q. 204. And how with respect to the intensity of illumination of electric lamps installed on such circuit?

A. If your inquiry refers to incandescent lamps, the incandescent lamp is the most sensitive electrical device to voltage changes of which we have any knowledge in the art. It has been stated by certain authorities, after numerous photometer tests, that a carbon filament incandescent lamp will vary in its intensity of illumination directly as the fifth power of the voltage. Very small voltage fluctuations at

the terminals of the carbon filament incandescent lamp will produce very marked changes in the intensity of illumination. In metallic filament lamps, the ratio of change, while not so great as with carbon-filament lamps, does vary in accordance with some power of the third or fourth degree, so that in this case, although the brilliancy of these lamps does not undergo so rapid a change as that of carbon-filament lamps, the change in illumination is considerable for small changes in voltage applied to them.

Q. 205. And where the generator of that type is excited by a separate exciter driven by or from the same shaft as the generator, would or would not this change in voltage take place, corresponding to a change in speed of the water wheel

A. The change in voltage under these conditions would be much greater than the change of voltage in self-excited generators, because the change in voltage of the exciter will be more rapid than the change in its speed. Therefore, not only will the main generators be operated at a higher speed than normal, but the density of the magnetic field would also be increased, so that the voltage changes would be of much greater degree than the speed changes which caused them, until the limits of saturation of the magnetic parts of the exciting and main dynamos were reached.

Q. 206. And how if the exciting dynamos were separately or independently driven?

A. If they were independently driven, then the

change in voltage of the main generator would be directly proportional to the change in speed.

Q. 207. So that under any of these circumstances there would be an increase in voltage producing an increase of speed of the mechanism driven on the circuit, or an increase of luminosity of the electric lamps upon an increase of speed. Is that correct?

A. Yes; that is true. And, further, the speed of all synchronous machinery which is not dependent on voltage for its speed, would be increased, due to the increase in frequency of the main generators in case of alternating current systems.

Q. 208. And now assuming a converse of these conditions, a decrease of load simultaneously with a decrease of head, and a maintenance of constant gate-opening, would the converse be true in the several particulars treated of, so that a decrease of potential in the electric circuit of the generator would ensue and a decrease of speed of driven mechanism, diminishment of luminosity of lamps, on the circuit occur?

A. Yes; the converse of the previously described conditions would take place.

Q. 209. In a plant so organized, that is, with a governor of this type, having an element responsive to both speed and load changes, and in which such changes of load synchronously with changes of head could occur, what would be the nature of the governing performance with respect to the requirements of a governor in a modern hydro-electric power plant?

A. It would be inoperative, for the reason that

the governor-controlling device could take different positions of equilibrium which would correspond to different speeds, and no governor could successfully control any water wheel unless the equilibrium of the controlling system were disturbed whenever the speed departed from any predetermined speed.

Q. 210. Returning now again briefly to this question of the returning action which you discussed this morning as being secondary action effecting the operation of the speed-sensitive governor, such as that disclosed in the patent in suit, is this returning action a voluntarily controlled action, or an action which is automatically responsive to the conditions set up in governing?

A. It is automatically responsive to the conditions set up in governing. , ,

Q. 211. And what have you to say as to the occurrence of this automatic returning action to prevent overrunning, or the movement of the water-wheel gate to an improper position consequent upon a disturbance of speed, with regard to the varying degrees of speed changes which the governor is called upon to correct?

A. I have previously explained the operation of this device, in which I pointed out that under ordinary conditions of a sufficient change in load to demand an appreciable gate movement, that the automatic returning device would move through the maximum distance that it is able to move, and in doing this it would compress the spring which imposes the additional external force on the governing sys-

tem. At the instant of beginning of governing, the pressure on this spring would be zero, and the pressure would continuously rise until the maximum pressure would be reached. After the maximum pressure is reached, if governing continue, the pressure then exerted to return the controlling device to its normal position would remain constant throughout that portion of the time of operation elapsing from the time that the spring is compressed to the maximum degree until the controlling device returns to its normal position. After the return of this controlling device to its normal position, the returning device is released and thrown immediately back into its normal position, and in this latter position exercises no influence on the controlling device. At this moment, however, there still exists an unbalanced force acting on the controlling device, for the reason that the controlling device has been forcibly returned to its normal position, thereby being brought back to its normal before the unbalanced forces themselves have been brought to equilibrium by the return of the water wheel to its normal speed. Due to the existence of this unbalanced force the controller will again operate and the gate again be moved. But this second time, assuming proper design and adjustment of the governor, the gate movement and the length of time that the machine should operate, would be very small and possibly a third, and, it might be, a fourth movement would be required to bring the gate to its final position. The statement that the gate moves a long distance and

nearly reaches its final point and then in a succession of small hitches or movements, step by step, each step being smaller than the preceding one, finally is brought to its normal position to correspond with the change in load, would probably best describe the action of the mechanism. In the case of the long step, or first movement, the return pressure exerted by the returning device would be in the main a constant pressure, because the period of time required for the long movement would be sufficiently great to enable the returning device to rotate through its maximum distance of movement and bring the spring which tends to restore equilibrium of the controlling device to its maximum pressure and hold it constant during the rest of the time that the governor would operate. During the second interval it is probable that this same condition would also be reached, but the duration of time from the point where the spring of the returning device had reached its maximum pressure and the return of the governor-controlling device to its normal, would be practically infinitesimally small. This is clear from the fact that the maximum force of the returning device has already proven itself to be stronger than the existing unbalanced forces by returning the controller to its normal position when the first step of gate-movement took place. Therefore, in the second or any succeeding step of gate-movement, it is obvious that the pressure exerted by the returning device to restore the controller to normal can never reach its maximum value, but must operate at some interme-

diate value. That is to say, the returning device friction disc cannot operate through the entire extent of its movement or throw, because prior to its reaching its maximum degree of movement the pressure caused by the returning spring will have overcome the unbalanced forces acting on the controlling device to return it to its normal position. Therefore, in the second step, the movement of the gate would be small, and the force set up by the returning device to return the controller to its normal position would be less than the maximum. Also, if a third step in the movement of the gate were made, the duration of movement of the machine would be less than for the second step, and the pressure set up by the spring of the returning device would also be less than the pressure which it previously set up for the second step. It is well known in the art that when rotating machinery departs from any fixed speed, the curve of relationship between time and speed is a parabola. The equation of this parabola, of course, depends on the relation between the mass which ~~N~~ is rotating and the forces which tend to change the velocity of rotation. This law is also obviously true for the return of a rotating mass from some speed below normal back to normal speed, that the curve of relation between the time and speed will be a parabola. In order that the governor of any prime mover may be a successfully operating machine, it is necessary that the impulses or forces which are brought into action as governing proceeds should be proportioned in some manner to meet the conditions

of speed, stored energy in the rotating mass, and all the forces acting in accordance with a parabolic curve.

Q. 212. A parabolic curve, then, expresses graphically the curve which will be followed by this rate of returning action?

A. Yes. The returning device should be of such character that the impulses given by the governor to open gates should correspond in degree for different intervals of time with a parabolic curve of which the ordinates would be represented by time and the intensity of the unbalanced forces impressed on the water wheel and rotating masses to accelerate or decelerate the velocity and bring it to some predetermined speed value.

Q. 213. Now, assuming that the level of the mercury in the make-and-break contact device shown in the patent in suit at "45-45a" were so that the circuit would be broken at that point before it were broken at either contact device "40-40a" or "41-41a", so that consequently after an initial effort the returning device would be thrown out of operation prior to one or more attacks by it upon the controller and the armature "34" of the solenoid "33" thereof, might not the consequent intermittent action of the returning device take place until a certain near termination point in such general governing action was reached?

Mr. Westall: Objected to as calling for a matter of surmise and conjecture concerning an arbitrary construction of a mechanical device not in any way

within the issues of this case, the patent showing clearly that no such construction is covered.

A. If the level of the mercury in cup "45" or the adjustment of the contact point "45a" be such that the circuit made by this contact is opened prior to the opening of either of the main circuit contacts, the result would be that the friction returning device would begin to return the controller to equilibrium and, after a short distance of motion of the controller, the compression between the discs of the friction returning device would be removed by opening the circuit of the electro-magnet which produces this friction, the returning device would then act no longer, the still unbalanced forces acting on the controller would cause a return of the controller to its unbalanced position where contacts "45" and "45a" would again be closed and the external elastic force of the returning device would again be reapplied, and it is probable that an adjustment could be reached whereby the water-wheel governor would act continuously from the beginning of gate movement until the end of gate movement, and the oscillation of parts taking place within the limits of making and breaking of the contacts "45" and "45a", and the friction removal and re-application through a recurring series of cycles of the force from the returning device acting to restore the controlling device to its normal position.

Q. 214. By Mr. Blakeslee: I now show you 'Defendant's Exhibit Berry Blueprint No. 1,' and 'Defendant's Exhibit M Z,' 'Defendant's Exhibit

XX," and "Defendant's Exhibit ZZ," and "Defendant's Exhibit Cobb Blueprint No. 1," and "Defendant's Exhibit Interior of Power Development Company's Power House," and ask you if you have examined the same?

A. I have seen these before, but never examined them carefully.

Q. 215. I call your attention more particularly to the features shown in Fig. 1 of "Berry Blueprint No. 1," to the part generally designated "B" in "Defendant's Exhibit Interior of Power Development Company's Power House," and to the part marked "B" in "Defendant's Exhibit ZZ," and to "Defendant's Exhibit M Z," and ask you if you understand what this grouping of parts purports to be?

A. I understand that these parts form a species of dynamometer device with centrifugal weights arranged within a fly-wheel, which weights are so arranged on levers that they tend to exert a force opposing the force set up by the dynamometer action, and also the arrangements comprises two tension springs which tend to assist the force set up by the dynamometer action. This is the understanding of the device which I gather from the drawings and prints of the exhibits mentioned.

Q. 216. Now, assuming, with reference to "Defendant's Exhibit M Z," that the part "B" is fast or the water-wheel shaft, and the annulus "M" is fixedly connected with the generator shaft, how will the rotation of the water-wheel shaft be transmitted to the generator?

A. In the drawing shown in the above-named exhibit the direction of rotation is counter-clockwise. Under these conditions the torque set up by the water-wheel shaft and transmitted through the diamond-shaped piece "B" will be transmitted to the generator, which is driven through the links "D", "D' ". The tension on these two links acts to pull the weights inward towards the center of the shaft. The centrifugal force of the weights which tends to cause them to move outwardly from the center of the shaft is apparently the force which balances the torque, and, in addition, the tension of the springs "S", and "S' ", thereby causing a transmission of power from the diamond-shaped piece "B" fastened on shaft "A" to the annular piece "M" fastened to the generator which is driven by the water wheel.

Q. 217. Assuming now that the water-wheel gates are controlled by connections between the arms "E", "E' ", carrying the weights, and such water-wheel gates, what general characterization would you give to this governor element as expressing the type of governor including the same?

A. I would call it a mixed-load-and-speed governor.

Q. 218. And with the use of such governor will or will not your previous testimony apply, wherein it is related to the use of a combined speed-sensitive and load-sensitive governor directly interposed between the water-wheel shaft and the generator shaft under the varying conditions treated of by you in such previous testimony?

A. Yes; the conditions and design regarding such device will apply to the one shown in "Defendant's Exhibit M Z," provided that my understanding of its operation is as I have outlined.

Q. 219. And how will this governor compare with the governor of the patent in suit with particular reference to the speed-sensitive element thereof, being the dynamo "8" of the patent drawing, "Complainant's Exhibit A?"

A. I cannot relate the two different arrangements at all. The speed-sensitive device of the patent in suit is subject to change only for change in speed, which change in speed is the secondary result of a change in load. The speed-sensitive device of the patent in suit will act to correct the speed of the water-wheel when it departs from its normal value, regardless of any surrounding conditions which may have changed the speed, whether these be due to change in head, change in load, or to any other cause. The governing device as depicted in drawing "Defendant's Exhibit M Z," would have some definite relation of its parts for a given load and a given speed. Any change in either of these conditions would produce a change in relation of the parts, and, therefore, produce motion of the water-wheel gates. This means that if the load were reduced, the speed increased; and then the load again thrown on before the increased speed had been compensated for, the weights "F", "F' ", would take a position farther from the center of the shaft and there be counter-balanced by the increased load. That is, a

he new position of equilibrium would be found, although the speed would have been increased. There may be several positions of equilibrium between speed and load, and a different speed for each one of these positions. Because of this characteristic, I would consider any device built in accordance with the drawing before me would be inoperative to maintain a constant speed. Furthermore, it would have a distinct disadvantage in that the angular relation between the driving shaft of the water-wheel and the driven shaft of the generator would be changed for changes in load, and this change would naturally be suddenly made, which means that there would be a sudden change in the angular velocity of the generator driven by the water wheel, lasting, of course, but a fraction of a second and extending through probably only a few degrees, but sufficient to cause electrical disturbances in the action of alternating current generators that might under certain conditions set up serious oscillatory disturbances over long distance transmission lines, particularly if these lines supply current to synchronous machinery.

Q. 220. Would a device organized like that depicted in "Defendant's Exhibit M Z," and applied between the water-wheel shaft and the generator shaft so that the torque of the former would be applied through it to the latter, and the water-wheel gate attempted to be controlled through the instrumentalities affected in position by such transmission, be a speed-sensitive governor device such, in kind, or possible performance, as that disclosed in the

patent in suit, and dependent particularly upon the action of the generator "8"?

A. No; it could not, for the reasons which I have already given.

Q. 221. Assuming now that the Examiner has not broken "Exhibit W," I now show you "Complainant's Exhibit W,"—it has traveled about 4,000 miles already—and ask you if you are familiar with this type of device, or this construction of device, assuming that its operation were as mechanically intended and not interfered with by the present fracture in the part No. 2974, and that that piece was continuous and unbroken.

A. Yes; I am familiar with it.

Q. 222. In practice, what is contained in the dashpot cylinder in this device?

A. There is a piston which normally has a small hole through it, and, in addition, there is at the upper part of this cylinder and within the rectangular brass box that is placed on top of the cylinder, two holes, one at each end of the cylinder, so that when the piston moves backward and forward, the oil which is placed within the cylinder is free to exude from one hole and be drawn in at the other. One of these holes has a stem passing into it the end of which is conical, and this stem may be adjusted so that the area of opening of the hole is greater or less as may be desired. The stem is attached on the outside of the cover to a projecting piece which is fastened to the upper end of the stud, this stud passing downward through the cylindrically shaped

piece arranged to receive it, and fastened at the end of the brass box above the cylinder and projecting toward the governing mechanism. This stud is provided with a spring which normally holds the conical-ended stud down into the hole at the end of the cylinder.

Q. 223. Have you ever personally used, attended to and adjusted such a device?

A. Yes; I have just finished the installation and adjustment of three governors having this identical device on them.

Q. 224. What is the name of the governor including this device, as known in the market?

A. Known as the Lombard governor.

Q. 225. That is the same Lombard governor you have referred to before as being made by the Lombard Governor Company of Ashland, Massachusetts?

A. It is.

Q. 226. Have you ever seen a governor of this type from which was omitted the V-shaped part upon the broken piece numbered "2974" and also the piece numbered "2975", and the adjustable connection working in this V-shaped piece, and opposed by the spring action, and the valve thus automatically adjusted in the action of the device?

A. I have never seen a Lombard governor without those.

Q. 227. If these parts last enumerated are not utilized, or if they were omitted from this Lombard

governor, what variation in the operative effect of the governor would ensue?

A. If all the parts of the governor were present except these parts which you have mentioned, the governor could not cause the main operating mechanism to apply force to move the gates in accordance either with the theoretical parabolic curve of return from a higher or lower speed to normal speed, nor even with a succession of points which would be substantially tangents to such a parabolic curve. Or, to express it physically, the tendency of the returning device of the Lombard governor would be to apply a constant force to return the controlling mechanism to its original normal position, which would so continue constant throughout the time of governing and regardless of the distance through which the governing mechanism had moved, or whether the movement were made in one step or in a series of successive steps.

Q. 228. And in what respect does the use of these parts last enumerated induce a variable tendency in the respect you have mentioned?

A. The action of the speed-sensitive device is attended by a movement of the piston in the dashpot, which, in turn, tends to move the dashpot, and were it not for the before-mentioned holes in the piston and dashpot the dashpot would move exactly with and as far as the piston. The holes in the dashpot allow the piston to move further than the dashpot itself, because some of the oil in it escapes through the holes, thereby providing for a certain

the amount of free travel of the piston. It follows from this that the pressure transmitted and received from the piston, will depend on the area of opening of holes in the dashpot. The parts which you have inquired about are so arranged that as the piston presses the dashpot forward or backward, the stud which I have previously mentioned and which is held downward by a spring is caused to ride on an inclined plane made by the V-shaped section of the piece numbered "2974", and in so doing it lifts the stud, and, with it, lifts the other stud which is connected with the first-named stud, the latter having a conical-shaped end which fits in the hole at that end of the dashpot. From this it follows that as motion of this returning-device proceeds, the pressure which it applies to cause a return of the parts of the controller to their normal position, greatly diminishes, so that the diminution in the pressure to the returning, approximately keeps pace with the diminution in the unbalancing of the forces in the controlling mechanism, which latter diminution is caused by a gradual return of the water wheel towards its normal speed.

Q. 229. And what results, with respect to movement and cessation of movement of the water-wheel gate, with relation to its proper position to govern the wheel in response to change conditions which have caused the variation of water-wheel speed?

A. This device acts to return the controlling mechanism to its normal position when it has become displaced, due to a change in the speed of the water

wheel, and to provide an external auxiliary force to assist in bringing the controlling mechanism back to its normal position before the speed of the water wheel has reached its normal value, and to thereby prevent overrunning or "hunting" of the water-wheel gates; and by the proper adjustment of this mechanism the governor can be prevented from moving the gates past their proper position whenever change in load occurs.

Q. 230. How about change in speed?

A. I use the terms "change in load" and "change in speed" to convey the same idea. Change in load causes change in speed, and, therefore, when I use the term "change in load", it is meant to convey the idea that change in speed follows.

Q. 231. And that is predicted upon the assumption that you are using a speed-sensitive device in this controller. Is that so?

A. Yes.

Q. 232. And that is in distinction to a purely load-sensitive or load-sensitive and speed-sensitive device in the governor, is it?

A. Yes, provided I understand by the last portion of your question that the load-sensitive and speed-sensitive device comprises one device in which the parts subject to change in position due to either load or speed are inter-related.

Q. 233. That is what I intended to imply. A unitary organization, in other words. If the parts last enumerated are omitted from this Lombard governor device, what will be the difference of action of

the governor with respect to bringing the water gate into proper position in accordance with the new position, causing change of speed of the water wheel, and holding the gate in that position to prevent overrunning?

A. Unless the gate motion be made to take place very slowly, that is to say, at such a rate that the acceleration or deceleration of the rotating parts will have time to ^{take} place while the governor is moving from one position to the other, the gates would be moved past the proper position, and the governor would "hunt"; that is, move the gates recurrently, past the proper position for the new load, going first too far in one direction and then back again too far in the ^{other} direction; and while a very slow moving governor might be made to operate the gates successfully, the time element of such a governor would, for most conditions in modern electric stations, be too slow to give satisfactory regulation.

Q. 234. Have you had experience with governors in which such elements as those last recited in connection with discussing "Complainant's Exhibit W," or similar elements for obtaining like results, were absent, or, if present, were improperly adjusted?

A. I have had experience in two cases. One that I recall dates back some fifteen or sixteen years, in which the governor allowed the generator speed in the water-driven electric railway plant to vary at least twenty per cent from normal in either direction. And I have just recently, that is, during the present

year, had experience with governors identical with the governors from which these parts of Complainant's Exhibit "W" were taken, where the parts were not properly adjusted, and with a change in load on the generators the speed would change going past the normal in first one direction and then the other, and continuously "hunting" until arrested by manually handling certain parts of the governor.

Q. 235. And in both these cases what were the results with respect to supplying properly stable electrico-motive force to the street railway motors and applying properly constant potential energy to incandescent lamps and other current consumers, upon the circuit in the second case?

A. We got an extremely bad condition of load in the case of the railway plant, because the station was located some six miles from the center of distribution, and although the generators were compounded for a ten per cent increase in voltage as between full load would actually cause a reduction in voltage of some ten or twelve per cent, due to decrease in speed, so that the electrical condition was that of a greatly increased current transmitted through a circuit with a reduced electro-motive force at the generator terminals. This, of course, resulted in a very great decrease of voltage across the motor terminals, with the result that motors were frequently burned out, it being well known in the art that this result often comes after marked voltage reduction. In the case of the last-named plant, I have been attempting to get the parties who are to take over the plant when fin-

ished, to receive current from the generators and begin operation of the plant so that acceptance might be obtained, and the behavior of the governors up to about three weeks ago was such that the people in authority declined to turn current on to their circuits from this plant, owing to the wide variation in speed, and, consequently, in voltage and frequency. This condition has since been corrected by proper adjustment, but it endured for four or five weeks before it was corrected.

Q. 236. You mean the adjustment of the automatic features in this variable returning action in the Lombard governor which you have just recently discussed?

A. Yes; it was the adjustment of these specific parts as shown in this "Complainant's Exhibit W," together with the co-acting portions operated by the short section of rack shown on the sliding block of this exhibit.

Q. 237. And prior to obtaining the proper adjustment of these parts did you attempt to energize incandescent lamps by energy from this plant?

A. No; we were not permitted to turn current on to the lamp circuits. We, however, did supply current to some motors driving pumps, one of which was a 500-horse-power induction motor and the other was a 350-horse-power synchronous motor, and the speed variations of these motors were so great that it caused the decision of the parties in authority not to permit current to be turned on to the general ser-

vice distribution system until the governing was more uniform and stable.

Q. 238. And had lamps been energized by the current from that plant at that time what would have been the illuminating constancy?

A. The intensity of illumination would have varied greatly and would have been unsatisfactory; and, in addition, the overvoltage effect would probably have burned out a large number of lamps.

Q. 239. And when a trolley car or electrical-motor-driven car suffers a burning-out of its driving motors when in service, what happens to the car and the passengers on it?

A. If only one motor is burned out, usually the car can be worked back to the car barn and repairs made, and this is usually the case. Seldom are both motors burned out. Of course, in the latter case the car would have to be towed back to the barn. Of course, in this latter case the passengers would have to get out of the car and take some other means of conveyance.

Q. 240. And as to such motor burnings and lamp destruction and interruption of industrial service due to such voltage variations, do these things run into money or are they merely negligible in operation in industrial and domestic and transportation service?

A. They obviously have considerable financial value, where power is supplied to textile mills, for instance, the threads in the spinning frames may become broken, and frequently are, with sudden

changes in speed, and the uniformity of speed is an absolute necessity for a uniform product, and to prevent shutting-down different spinning frames to restart the threads. Also, in supplying power to paper manufacturers where Foudrinier paper machines are used, any slight increase of speed, if sudden, will tear loose the paper, and then it requires a consistent period of time to start the paper back through all the machinery and heating rolls and onto the winding rolls, so that the question of speed change in industrial plants and in illumination, becomes an important factor.

Q. 241. What does it cost to rewind and rehabilitate a motor of the type used in running a street car when it is burned out, as you have mentioned?

A. It depends on many factors and the degree of destruction. Also, in case of a small railway plant with a limited quantity of rolling stock, it may be a matter of considerably greater loss than that represented by the cost of rewinding the burned portions of the motor, because it may take one of the important pieces of rolling stock out of service at a time when it is greatly needed. But to carry the car into the barn and dismantle the motor and then re-assemble it, costs not less than \$20 to \$40, depending on the arrangements made, and then the cost of winding may in itself be trivial—sometimes not over \$6 to \$8, although there are other times when it may run several times this amount.

Q. 242. And such car may be thrown out of service for a number of days?

A. Hardly for a number of days, but certainly for not less than twenty-four hours, I should say, under ordinary and usual conditions.

Q. 243. And that results in tying up an investment proportionate to the cost of the car and the percentage of overhead expense attaching to the maintenance and operation?

A. That is true. In companies with a large system that is negligible. In companies with a small system, where there is but little rolling stock and one car forms a considerable percentage of the total, it becomes a serious matter.

Q. 244. What have you to say with respect to the action of the Lombard governor as part of the controlling system of a hydro-electric plant, including the features present in "Complainant's Exhibit W," as to its action in causing the water-wheel gate to come to its new position and stay there, in comparison with the action of the returning-device disclosed in the patent in suit "Complainant's Exhibit A," and including the several features thereof which we have previously discussed, namely the clutch parts "22" and "23", the rod "25", "25a", the electro-magnet "32", the springs "28" and "29", and the several connections for energizing the electro-magnets, etc.?

A. The function and the ultimate results obtained are the same in both these returning devices. In one there is the elastic pressure acting pressure acting on the controlling mechanism; in the other there is the pressure produced by compression of a

gradually diminishing volume of oil, which is opposed by an elastic spring pressure. In the case of the patent in suit, after the water-wheel gate has been moved through a certain distance, that is, the first step in governing taken which has been described, a series of very short, gradually diminishing, successive steps are taken, in each of which the pressure brought to return the controlling mechanism to its normal position takes place. In the Lombard governor the continued motion of the compensating mechanism produces a continually diminishing pressure in the dashpot, and, therefore, a continued reduction in pressure acting against the spring of the compensating mechanism, this latter effect being due to the gradual ^{upward} movement of the stud having the conical point that fits into the relief hole at one end of the dashpot, as has previously been described.

Q. 245. And may the returning actions of both these returning devices be expressed graphically by a parabolic curve such as you have mentioned?

A. I would say that the action of these returning devices is such as to cause the governor action to be such that it would follow the parabolic curve of return of the rotating parts from an erroneous speed back to normal.

Q. 246. That is, the ultimate effect upon the speed of the water wheel to restore it to normal, consequent upon the action of these two returning devices, may be expressed graphically by such parabolic curve?

A. Yes.

Q. 247. Referring now to "Complainant's Exhibit A," the patent in suit, I will ask you why within your conception of the invention and the disclosure of your invention as entering into your sworn application for the patent in suit, turnbuckles were provided as shown in Fig. 5, in both courses of the rope or cable extending to the lever "50," actuating the butterfly by-pass valve, if these be turnbuckles, and if I am not correct in assuming they are, please so state.

A. These are turnbuckles. They were placed in both of the rope cables which lead to the by-pass valve lever for the purpose of adjusting the by-pass valve and pulling up the ropes tightly thereafter to prevent any slackness in them or any lost motion which would accompany such slackness.

Q. 248. And tightening up one of these turnbuckles and loosening up the other one with the by-pass in any initial position, would produce what effect with respect to such by pass valve position?

A. It would change the normal position of the by-pass valve at which it would have to come to rest when governing was completed.

Q. 249. What, then, was your conception of the normal position of the by-pass valve disclosed in this patent?

Mr. Westall: The question is objected to on the ground that the witness's conception is not material here, nor his intention in providing any mechanical means or parts, unless that intention or conception is expressed in the patent in some manner, or unless

some indication is contained in the specifications that such device is to have some such use.

A. My intention at the time that this invention was made, and as expressed to the ~~E~~attorneys who acted for me in securing this patent No. 695220, was that when conditions were such that it was desirable to have the auxiliary by-pass valve operate in both directions, and when a sufficient supply of water would be available to permit continuous waste which would proceed from maintaining it partly open as its normal position, that its normal position would then be half-open and half-closed, and motion of the water-wheel gate in either direction would be attended by a corresponding inverse motion of the by-pass gate in either direction. But whenever the water supply should become diminished below a quantity which would provide a considerable excess of water above the amount needed for power purposes, the by-pass valve would be adjusted so that its normal position would be completely closed, and it would then operate in only one direction, namely, to open whenever the water-wheel gate should close. In this way the governing would be better than that obtained without any by-pass valve at all, and no excessive pressure due to a rapid change in the total amount of gate opening at the end of the penstock could be produced. At the same time, the continual loss of water would not take place, and there would be only a small loss at times of governing, and whenever the direction of water-wheel gate motion was toward closing. In this way a better degree of governing and

a factor of safety against rupture of penstock would be provided, without any appreciable loss of water, so that in this way and adjusted in this manner the by-pass valve could be operated even under conditions of drought and inadequate water supply for power purposes.

Mar. 9, 1915 A. M.

Q. 250. You have testified to having recently installed, operated and adjusted three Lombard governors, including features of construction identical with those of "Complainant's Exhibit W," and also have testified to having just finished the work of construction of a hydro-electric plant at Austin, Texas, in which are installed Lombard oil-pressure-actuated governors. Is there any connection between these two installations of Lombard governors?

A. They are identical.

Q. 251. I again call your attention to "Defendant's Exhibit Cobb Blueprint No. 1," and to "Defendant's Exhibit Berry Blueprint No. 1," and more particularly to those features operated from the alleged governor device which you described yesterday in connection with the plant concerned, and being the valve mechanism purported to control the position of the water-wheel gates, and the alleged by-pass device, being principally the part shown at "O", "P" and "N" in the first-mentioned exhibit, and the parts numbered "22", "23", "24", "25", "27", "28" and "21", in the last-mentioned exhibit, together

with the internal piston, valves and the like, necessary to render such a think in any sense operative, and I will ask you if you have a general understanding of the apparently intended mode of operation of these features. In this connection you may pick out either group of elements you wish, upon the assumption that the general construction and mode of operation represented is the same in each instance.

Mr. Westall: Let the record show that the witness has stated that he did not understand the device thoroughly, and that he had not heretofore examined it, and that he is not sure that he understands the operation of the device, and that he has spent five minutes endeavoring to figure out how the device operated.

Mr. Blakeslee: We will qualify the last question first by admitting that the blueprint appears to be a poor piece of work and difficult for any engineer accustomed to good mechanical drawings to follow, and that it does not apparently show some of the things testified about by defendant's witnesses. However, we will continue in qualification of the last question, by basing the same upon the assumption that with reference to "Defendant's Exhibit Berry Blueprint No. 1," the part "24" is a slide valve controlling admission of pressure fluid to the cylinder "25" to oppositely actuate piston "26" therein, which is provided with the piston rod "27" and connected at "28" with the floating lever "21", which, in turn, is connected at "20" with the bell-crank "19", actuated by the attempted governor device. The

slide valve also controls outlet by-pass, the service pipes of which are shown at the ends of the valve casing, controlled by said slide valve and permitting escape of fluid from the ends of the casing. And let it now be further assumed that the piston rod "27" connects with the controls of the attempted by-pass device and the water-wheel gate valves.

Mr. Westall: Counsel for defendant objects to the leading nature of the question, and to counsel for plaintiff testifying in the manner he has, but is willing to permit the question to stand, simply for the purpose of showing how thoroughly and easily the drawing is understandable, even by one unskilled in the art who has given the subject any attention whatever.

Mr. Blakeslee: Counsel will not attempt to qualify himself, as he is not about to testify nor has he testified. I believe such qualification would be superfluous, as we will leave the court to judge by his examination of this witness. However, the question is based now upon the presumption, and that is as far as we are concerned with the question, and if the question is answered on that presumption it will satisfy us in all respects.

A. With this explanation of what the lines in the drawing are really intended to depict, I now understand the relation of the parts and how they would operate in an actual mechanism.

Q. 252. Now, with that understanding, and with the parts connected as assumed with the attempted governor device, or any governor device,

and also with controlling means for the attempted by-pass device, and water-wheel gate valves or any like valves or gates, please state what the operation of the parts specified would be.

Mr. Westall: Objection is made that the record clearly shows that the witness is not qualified by a previous study of the device to state with any degree of positiveness what the operation of the device would be, and that, therefore, any conclusions that he may express would be in the nature of mere guesses or surmises influenced by his position or by his being called as a witness on behalf of complainant, and by his interest in the case as the patentee.

Mr. Blakeslee: The witness has had placed before him the statement, that is, a hypothetical statement of facts, and we contend he is sufficiently qualified to discuss such facts and to state the result of operation of the parts mentioned, and we do not call for a conclusion, but for a statement of facts based upon such hypothetical construction supported by what the witness as a skilled engineer may find in the drawings themselves.

Mr. Westall: Objection is also made that the hypothetical question is fragmentary and not so complete as to bring it within the issues of the case and make any answer that might be based thereon of any value in determining any of the issues of the case.

A. In case the load should change, there would be a movement of the arms of the governor wheel due to change in the torque transmitted from the

water-wheel shaft to the driven shaft, which, in turn, would move link rod "17" and the bell-crank "19". The piston rod "27", being stationary at that moment, the pivotal point of floating lever "21" would for that instant be fixed, as it is fastened to the piston rod. If the movement were such that lever "17" were moved toward the left, the piston valve "24" would be moved upward. This would admit whatever fluid pressure might be used to operate the machine to the upper end of the piston and motion of the piston rod would begin, and this motion communicated to the water-wheel gates would cause their movement toward the new position corresponding with the change in load. When the arms in the governor wheel have moved to their new position, due to the change in load, moving with them the piston valve, as before described, and these governor arms become fixed in their new position, then the link "17" and bell-crank "19" are also fixed, and the floating lever "21" now has a fixed pivotal point at its upper end, while the lower end at "28" on the piston rod, which at the beginning was a fixed pivotal point, is now a moving or operative point, the motion of the piston taking place now taking place in a downward direction. This downward movement of the piston also produces a downward movement of the piston valve, which valve had previously been moved upward. So that in the action of governing the piston rod which moves the wheel gates also acts to move the controlling valve back to its neutral position. When the piston has moved a suf-

ficient distance to have brought the valve back to its neutral position, motion would stop. If governing were uncompleted, assuming now that the speed and load control mechanism were operative, the piston valve would again be moved in the same direction as before, causing a motion of the main operating piston in the same direction as before, which motion would continue until the controlling valve is again brought to its neutral position, and in this way governing would proceed. It might be that by appropriate design and adjustments that not over two steps would be required, or two consecutive movements, although it might be possible that three or four steps, each being shorter than before, would result. All this, however, is based on the assumption that the controlling mechanism is operative.

Q. 253. By Mr. Blakeslee: Do you find in this construction of parts an inter-relation of features, or do you not find such an organization, as will cause the piston valve "24" to be returned to its normal position and held there during a returning action of the governor element in the fly-wheel, including the centrifugal arms and weights, while the wheel is re-assuming its ultimate correct speed?

A. In view of the character of the controlling mechanism, the specific action of the actuating piston and the controlling piston valve cannot be definitely determined without an assumption as to what takes place in the controlling device itself, the drawing of which is marked "Fig. 1" in "Defendant's Exhibit Berry Blueprint No. 1". Some assumption has to

be made as to the action of this device, because it is not a suitable operating mechanism and for the same conditions of load may operate at different speeds. If it were strictly a load-governor, then the position of the arms in the fly-wheel and carrying the weights "3", "3" would be fixed for any specific load, provided the speed were constant. That is, there would be some definite position of the arms to correspond with any definite load, and the position of the arms would change, therefore, for change in load. In this case the gate-moving mechanism should be made to respond so that the movement of this mechanism would be exactly proportional to the movement of the gate arms. The gate-moving device for piston and controlling valve seems adapted to perform this very function. The link "17" will move the bell-crank "19" and with it the controlling valve through a distance proportional to the change in position of the governor arms. This being the case, piston "26" will have to move through a distance which is proportional to the displacement of the valve "24", and by a proper adjustment this device could be so made that for each displacement of the arms there would be a corresponding motion of the piston "26" and of the gate rigging, which controlling valve is brought to its neutral position, and operation ceases. There is, however, another element introduced, which is that the governor is apparently responsive to speed changes; and since, as I have before pointed out, it is impossible to combine in one element these two functions of load and speed

change, it is impossible to say what the exact performance of this machine would be, unless all the other attending conditions are likewise given.

Q. 254. Let us assume, then, that the governor element actuating the link rod "17" is a purely speed-sensitive element. What, then, will be the operation of the actuated parts we are discussing after the water-wheel gates have moved to their new position, responsive to governing action and before the speed-sensitive device has returned to its normal speed, and its parts have assumed the corresponding final positions normal after a governor action. Will there or will there not be further movement of these enumerated parts prior to the speed-sensitive element assuming final and normal position of the parts, to cause overrunning of the governor?

A. Considered as a speed-operated device, the governor would "hunt" and would overrun first in one direction and then in the other, and, if it should come to rest at the proper gate opening, it would be after a considerable period of time, and comparatively a large number of operations in both directions.

Q. 255. Could or could not these several features of this "Berry Blueprint No. 1" either with the attempted governor devices therein shown or with the speed-operated or speed-sensitive governor device you have referred to, acting in substitution therefor, perform the functions of a Lombard governor including the features of "Complainant's Exhibit W," or of the governor of the patent in suit,

"Complainant's Exhibit A," including the returning device which you have described as disclosed therein?

A. No; it could not.

Q. 256. And would or would not the damaging and improper actions and results occur which you have referred to when such Lombard or like governing device was not employed or was improperly adjusted, namely, interference with proper operation of the motors of a traction system, and with pump-operating motors, lights and the like, upon the circuit supplied by the apparatus so governed?

A. All the objectionable results which would proceed from speed variation would be present in a system driven by water wheels controlled by the device disclosed in the blueprint "Defendant's Exhibit Berry Blueprint No. 1".

Q. 257. I now show you five sheets of paper bearing sketch and sketch-designating matter, lettered "A", "B", "C", "D" and "E", respectively, being respectively "Complainant's Exhibits Wilson Sketches A, B, C, D and E," and I will ask you if you have examined the same.

A. Yes; I have examined these sketches.

Q. 258. As to the several valves therein shown, is it possible in any manner to classify the same generically with respect to valve movements and actions and, particularly, the relations between the valves and their seats or co-operating parts in such valve actions?

A. Yes.

Q. 259. Please so classify them generally.

A. The valves shown in sketches "A" and "B" are generically different from the valves shown in sketches "C", "D" and "E".

Q. 260. What is the generic difference so existing?

A. The valves shown in sketches "A" and "B" are free-moving partially or totally balanced valves which do not contact with valve seats except when in a completely closed position, and which do not slide on the valve seats, and, therefore, in which no friction can exist between the valves and the seats. The valves shown in sketches "C", "D" and "E", with the exception of the water-wheel gate shown in sketch "C", are all valves which are in constant frictional contact with the seats or the surrounding portions thereof. Furthermore, none of the valves shown in sketches "C", "D" and "E" is a balanced valve. The difference between the two types, as generically classified, mechanically is simply this: that one valve is easily moved from one degree of opening to the other, while the other type requires a comparatively great force or amount of power to operate it.

Q. 261. Which type requires such comparatively great amount of power to operate it? That is, which class?

A. The unbalanced valves having frictional contact with the slides or surrounding parts, such as indicated in sketches "C", "D" and "E". In sketch "C" I refer, of course, only to that valve labeled "by-pass

valve." The water-wheel gates shown in sketch "C" are of a mixed type, having friction on two of the sides only, and they, therefore, represent a more easily moved valve than the others shown in Sketches "C", "D" and "E".

Q. 262. And how about the water-gate valve shown in Sketch "B"?

A. They are of the same type as the valve shown in sketch "C", the characteristics of which I have just mentioned.

Q. 263. Does the by-pass valve shown at "48" in "Complainant's Exhibit A," the patent in suit, fall within either of these general classifications, and, if so, which?

A. It falls in the same classification as the valve shown in sketches "A" and "B".

Q. 264. And in selecting such type of by-pass valve in the working out of your invention and the disclosure in the patent, why did you make such selection?

A. Because this is one form of a balanced and substantially frictionless valve, and for successful governing some type of by-pass valve having these characteristics is necessary. In other words, it would have required a machine of such size, strength and cost to operate an unbalanced valve having friction, that the device would be commercially impracticable.

Q. 265. I refer you now again to "Defendant's Exhibit Berry Blueprint No. 1," and call your attention to the water-gate valves shown therein as at

“48”, attempted by-pass valve shown therein at “41”, and will ask you if either of these falls within either of the classifications you have just made and, if so, which, and within which classification.

A. As I understand the drawing of the water-wheel gate valves and the by-pass valve, both belong to the same type. That is, rotating valves which are completely surrounded by the valve seats and which, therefore, must be subject to considerable friction if the valves are reasonably water tight. They, therefore, come within the classification in which the valve is shown in sketches “C”, “D” and “E”, previously described, would fall.

Q. 266. Is there any general name by which the attempted water-gate valves and the by-pass valves in the blueprint last referred to are known in the trade or art?

A. Yes; they belong to the type known as plug cocks.

Q. 267. And what have you to say as to the effect upon the same of service fluid pressures, such as would be encountered were they subjected to the pressure of penstock water in water-wheel parts, and as opposing movement of the same in their seats?

A. Plug-cock valves, except in small sizes, are very difficult to move even when the water pressures acting against them are not considerable. This is evidenced in the ordinary daily experience of nearly everybody in handling usual plug-cock valves at wash-basins and elsewhere which usually have a plug

or rotating member of less than $\frac{5}{8}$ -inch in diameter. In plug-cock valves of such dimensions as would be necessary to handle the large quantity of water necessary for the operation of even a small hydro-electric plant, the energy required to move them would be comparatively very great. Just how much this energy would be, would depend, of course, on the construction, the co-efficient of friction between the parts, the diameter and other factors. But, in any case, I would consider the operation of plug-cock valves for any purpose in connection with handling considerable quantities of water as commercially impracticable.

Q. 268. And what would the result be in attempting to operate such plug-cock type valves in such water wheel practice where the same were attempted to be actuated by a sensitive governing element?

A. A governor suitable for operating valves of this type in controlling the speed of water wheels would have to be so large and costly that it would be a commercial impossibility to construct and install it.

Q. 269. Now, let us assume that fine sand or schist or other comminuted matter found its way between such plug-cock valves and their seats. What would be the effect of the frictional factor so introduced upon the otherwise difficulty of moving such valves?

A. It would greatly increase the energy necessary to move such valves, the amount of it, of course, de-

pending on the character of the workmanship and the degree of water-tightness of the valve. In any case, the order of increase would be that of several times the frictional resistance which would exist when no sand or other foreign substance was present between the plug and its seat.

Q. 270. Now, if in connection with plug-cock valves so employed or attempted to be employed in water-wheel regulation, water were used like that of "Complainant's Exhibit Bottle of Kern River Water at Power Development Company Plant," and having the visible content of such sample of water, what would be the effect upon frictional co-engagement of the plug-cock valves and their seats in the attempted operation of the plug-cock valves by the governor apparatus?

A. I do not consider that the content of the water as visible from this sample would change the frictional resistance to the motion of a plug-cock valve, and, if it should, the change would be so small as to be practically negligible.

Q. 271. By such optical examination as you can make of this sample of water, do you find any reason to believe that the application of such water to these plug-cock valves would or would not vary the action of the valves upon their seats, as compared with the friction of chemically pure water without content whatsoever?

A. There is nothing visible in this sample of water which could change to any appreciable degree

the frictional resistance to motion of the plug-cock or other form of rotating or sliding valve.

Q. 272. Referring again to "Complainant's Exhibit A," will you please state whether or not at the time you conceived your invention therein disclosed the several electro-magnets, contact devices, including the mercury cup contacts, the solenoid and the electric generator, and the various other features providing for electrical transmission and for making and breaking electrical circuits, were well known in the art?

A. All of these elements were well known as individual devices and had been in use prior to my conception of the idea of combining them for the specific purpose described in the patent.

Q. 273. Is the same also true of the several levers, rods, links, bell-crank and the gears, clutches, friction discs and other mechanical features disclosed in this patent?

A. Yes; it is true of every portion of the patent except the combination of the bell-crank "42" and the curved slot "44" in the end of the lever "43" as shown in Fig. 6 of the patent in suit. This I believe to be a mechanical device original with me. But, except this, all the other parts were well known in the electric and mechanical arts.

Q. 274. And had those parts last specified, well-known mechanical equivalents at that time?

A. Yes. Those parts were a substitution for other methods for performing the same function as disclosed in the original sketches.

Mr. Blakeslee: Counsel for defendant may cross-examine.

CROSS-EXAMINATION

By Mr. Westall:

XQ. 275. How many concerns in the United States are there which manufacture or sell water-wheels or water-wheel governors, if you know, approximately?

A. I do not know, but I do know that the number exceeds thirty.

XQ. 276. You have stated that prior to and since the granting of your patent you have been in communication at various times with those who manufacture and sell water wheels and water-wheel governors, in an attempt to interest them in the device of the patent in suit. I will ask you to please mention the names of the concerns which you there approached.

A. I do not now recall them all. I have approached the Lombard Governor Company several times, the Woodward Governor Company, the Pelton Water Wheel Company, the I. P. Morris Company, the Allis-Chalmers Company, the S. Morgan Smith Company, the Platt Iron Works Company, the Wellman-Seaver-Morgan Company, the Sturgis Governor Company, besides others whose names I do not now recall.

XQ. 277. At what time during the interval between the grant or between your first conception of the invention of the patent in suit and the assign-

ment to Mr. Henry of the patent, did you communicate with these various companies and individuals which you have referred to in your previous testimony?

A. The original communications and the subsequent attempts at negotiation covered the entire period from nearly four years prior to the grant of the patent up to the time I sold it to Mr. Henry. Within sixty days before my negotiations with Mr. Henry began I had again discussed the matter of selling the patent to the Lombard Governor Company.

XQ. 278. Had your efforts during the last three or four years prior to the assignment of the patent in suit to either sell or to compel some kind of a settlement for alleged infringements by any of the companies or individuals which you have mentioned, been carried on with as much vigor as they had been prior to that time?

Mr. Blakeslee: Objected to as calling for a mere arbitrary conclusion based upon facts impossible of weighing as to the conclusion.

A. As to the relative zeal and vigorousness with which I prosecuted the attempts to obtain settlements or to effect sales of the patent during different periods of my ownership of it, it would be difficult for me to say. By the time that Mr. Henry began negotiations with me for its purchase, I had nearly exhausted the possibilities for doing anything with it, so far as my own ability was concerned. I had begun by offering it in the early days of my ownership to practically every interest that in my opinion

might become interested. As one after the other of these parties would decline to either purchase the patent or take a license under it, the possibilities began to narrow more and more, and, naturally, with this diminution in possibility, there was a corresponding reduction in the amount of time which I gave to attempting to utilize the patent, although I at no time ceased my efforts to place it or sell it, and the intervals which elapsed between attempted negotiations were produced partly by the fact that within the past few years there were but few openings for it, and also it was necessary for me to devote practically all of my time to my professional work, as I was, and am, without income from any other source.

XQ. 279. By Mr. Westall: Did you threaten suit against any of these concerns for alleged infringement of the patent in suit at any time?

Yes; at various times. I called the attention of certain companies to the fact that they were manufacturing devices which infringed my invention, and that it was my intention to bring suit unless a satisfactory settlement were made.

XQ. 280. Against which of these concerns or individuals mentioned by you in your previous testimony did you make these threats of suit?

A. The Allis-Chalmers Company, the Pelton Water Wheel Company, the Lombard Governor Company, the threats of suit being made by me personally. About the year 1910, if my memory is correct as to the date, I placed the patent in the hands of Mr. H. C. Messimer of New York, and asked him

to make preliminary statements to certain of the infringers with regard to the necessity of their making some settlement. I do not now remember the companies with which he communicated with the exception of the Sturgis Governor Company. I may add that one of the difficulties which I labored under was the fact that I was very well known to most of the manufacturers or to some of their representatives, who fully understood that, being dependent upon my professional work for income. I was not prepared to bring a suit which I could actually fight through to a final decision, and it is possible and, in fact, I think probable, that this condition greatly affected the conclusions that the several companies infringing this patent reached, namely, that there was no necessity to give serious consideration to my claims or my suggestions of suit.

XQ. 281. And who was this Mr. Messimer in whose hands you placed the matter of threatening these companies in 1910, as you have testified?

Mr. Messimer is a patent attorney whose offices are in the Liberty Tower Building in New York City.

XQ. 282. And how long was that matter in the hands of Mr. Messimer?

A. I believe it was in his hands fifteen or eighteen months. In this time Mr. Messimer, when he had the opportunity, communicated with certain infringers of the patent, though as I have before stated I do not remember now who they were, excepting the Sturgis Governor Company.

XQ. 283. And did Mr. Messimer advise you to bring suits against any of these different concerns?

A. Mr. Messimer advised me that it would be proper for me to bring suit under the conditions of the infringement and the existence of the patent. But Mr. Messimer, being my own attorney in other matters, was fully aware of the impossibility of my entering into and carrying on a suit to its final conclusion.

XQ. 284. In other words Mr. Messimer was doubtful as to the outcome of such a suit if one had been instituted?

A. He never indicated that he was doubtful of it. He was fully assured that I was not financially able to carry on such a suit, regardless of whether the outcome was doubtful or not.

XQ. 285. And so he never expressed any opinion to your recollection as to the probability of success of such a suit?

Mr. Blakeslee: We object to this manner of cross-examination as not calling for the best evidence, not cross-examination, and as seeking not only for a matter of opinion but for a matter of repeated opinion, and, furthermore, as entering into matters of privileged communications between client and his attorney, and not proper to be inquired into at this time and of this witness. The question would certainly be barred if asked of the Attorney Messimer, and as the best evidence would be that of the Attorney Messimer, and such evidence would be properly barred, the question is manifestly improper and not

within the laws of evidence. And we furthermore warn the witness of his rights in this respect and as to any matters pertinent to advice and consultation as between the witness and his counsel, he need not answer the question unless instructed by the court.

Mr. Westall: Counsel is correct in his statement that the question asked of the attorney would be improper. But he is manifestly in error in stating that such a question is improperly asked of this witness. It is submitted that the question is entirely proper, and the instruction of counsel to the witness not to answer can only have been given on the theory that some evidence damaging to his side of the case would be brought out.

Mr. Blakeslee: We object to this statement of counsel as argumentative and forbidden by Equity Rule 51, and again call the attention of counsel to the portion of our objection which is that the question deals with a mere matter of opinion and not a matter of fact, and as not being proper cross-examination.

A. Mr. Messimer not having been retained by me to carry on a suit, did not fully investigate the patent nor the character of the infringements. He acted on my representation that my patent was a pioneer patent, that the invention antedated any possible use of the elements therein shown, and that the parties whom I mentioned to him were making similar structures. And on the basis of these representations by me, he communicated with the parties who I claimed to be infringers. I do not recall that Mr. Messimer ever made any statement about the

outcome of the suit, because it was well understood between us that I was not in any position to bring a suit, and, therefore, I do not remember ~~that~~ this matter was discussed at all. I, however, do know that Mr. Messimer would never have made a demand for settlement if he were not reasonably sure in his own mind that there was proper ground for doing so.

XQ. 286. By Mr. Westall: How long before your application for the patent in suit had you been engaged in the profession of engineering in any of its branches?

A. I began in practical engineering work in certain manufactories in which my father had an interest at the age of about fourteen years. I began my engineering study at the age of about sixteen—

XQ. 287. (Interrupting) I perhaps can shorten the question by saying that I mean the time when you were earning your living from your engineering practice.

A. I began my living from my engineering practice prior to the completion of my college education. I spent one year in practical work in machine-works before going to Stevens Institute. This was subsequent to the time when I attended the University of Georgia. I left Cornell University in the summer of 1894 and immediately began making my living in engineering work. I therefore had been so engaged subsequent to leaving college,

XQ. 288. Have you since entering the engineering profession been fairly successful?

Mr. Blakeslee: Objected to as calling for a con-

clusion, as to which the witness is possibly not the best evidence, and it does not call for a statement of facts as to the work done by the witness, as to which the evidence is already complete.

A. It would depend on your definition of the word "success." If it means the production of new devices and investigation of new methods, of various engineering—

XQ. 289. By Mr. Westall: (Interrupting) Assuming that it means success in a financial way, as ordinarily understood.

Mr. Blakeslee: Objected to as indefinite, and upon the same grounds last urged.

A. I would not say that I have been successful financially, because my expenditures have consistently reached if not exceeded my earnings.

XQ. 290. By Mr. Westall: Could you state in a general way approximately what your expenditures per annum have been?

Mr. Blakeslee: Objected to upon the same ground, and as not proper cross-examination, and as inquiring merely into the private affairs of the witness, and in that respect not tending to prove or disprove any of the matters in controversy here, and being merely a question of busy-body nature. The witness is informed that he need not go into details at all, unless instructed by the court.

A. I would scarcely care to lay on public records matters of private personal expenditure with the correlative information of my specific obligations which cause these expenditures. I can only state

that the ratio between my income and expenditures for the maintenance of my engineering office and of my family and such other obligations as I have been obliged to meet, have been such that I have never had a sufficient surplus to have undertaken any enterprise which required even a small amount of capital.

Mr. Westall: In response to counsel's statement of record, it is pointed out that the witness has testified that he has not been able financially to bear the expense of a suit for infringement of the patent in suit, and that the inquiry is directed to bringing out specifically the nature of his financial condition, so that the court may judge whether his conclusions as expressed on direct examination are well founded, and that, therefore, the question calls for a more specific answer as to just what his obligations were. With this explanation of the object and purpose of the question, the Examiner is requested to repeat the question.

Mr. Blakeslee: We repeat our objection. The witness has stated a fact, and not a conclusion. It costs varying sums of money to bring and sustain suits for infringements of patents, and the witness may have had \$10,000 available for such purpose and have considered that that would have been insufficient to bring such suit. Therefore, there being no standard to go by, the statement of fact by the witness as to his inability to sustain and maintain such suit is as far as any such inquiry could go. If counsel wishes to ask the complainant if at any time he

had \$10,000 available to bring and maintain such suit, we will not object to the question. But the question prying into the financial affairs of the witness is manifestly improper and unwarranted.

A. I am willing to make a partial answer to the question, which is to this effect: that at no time in my career have I been able to devote as much as \$3,000 to the prosecution of a suit of any kind, nor have I been in position to have expended that much money even if I had been absolutely assured that within the course of legal events I would have been granted a full judgment for whatever claim I might have made.

XQ. 291. By Mr. Westall: Did any of the concerns against which you threatened suit make, sell or use any device, which might properly be described by the claims Nos. 6 and 7 of the Lyndon patent in suit?

Mr. Blakeslee: Objected to as calling for a legal conclusion, improper cross-examination, the claims being integral parts of the patent in suit and requiring interpretation as to their scope, and as to which the court has the prerogative.

A. I had never seen a governor in which the elements shown in claims 6 and 7 were present, so far as I know, and my claims on the various companies which I alluded to were made on the basis of statements which came to me that equivalent constructions were being used.

XQ. 292. By Mr. Westall: So that you did not personally investigate or have any personal accurate

knowledge as to just what was being made by any of the companies against which you made the threats of suit?

A. Yes; I made investigations of a certain kind, which would have been sufficient to have instructed an engineer, although I believe might not be accepted as legal proof. For instance, in the case of infringement by the Allis-Chalmers Company, this I was informed first took place in the installation of the Great Northern Power Company at Duluth, Minnesota. I wrote to the chief engineer of the company and asked him about the construction, and he replied informing me that a by-pass valve had been supplied by the Allis-Chalmers Company, operated inversely to the main gate by the governor mechanism, and arranged to return slowly to its normal position. From this I reached the definite conclusion that there was an infringement. Never having seen the structure, I am unable to relate it to the claims numbers 6 and 7 of the patent in suit further than these statements would relate to these claims.

XQ. 293. But you believed from those statements that it did relate, and you did believe that it was covered by those claims or some of the claims of the patent in suit?

A. I was positive of it.

XQ. 294. And when did you hear of this installation and when was it manufactured and used to your knowledge?

A. To the best of my memory all this occurred in the year 1904. When it was manufactured, I do not

know. I simply heard of the installation and wrote about it. It might have been just installed, or it might have been in operation two years. I only heard it was installed.

XQ. 295. Please state the circumstances as to time and place and construction of apparatus which were incident to your threats of suit against any of the other companies that you have referred to as having been threatened by you with suit.

A. They were all based on statements which came to me, sometimes made to me by other engineers who knew that I was interested in the matter of speed control of water wheels, and sometimes from discussion of plants published in the various technical journals. It is impossible for me at this time to remember the dates and the circumstances attendant upon each one of these. Sometimes the communication was, as I have mentioned entirely verbal, but made with the positiveness of an eye witness and by an engineer competent to judge. On the basis of such statements, whether verbally made to me or appearing in technical journals, I would communicate with the companies who its was stated were making the infringing apparatus, in an attempt to obtain a recognition of the rights granted me under the patent in suit.

XQ. 296. Did either company to your knowledge at any time prior to 1904 ever make any construction which seemed to you to be covered by any of the claims of the patent in suit? And, if so, when, and under what circumstances.

A. As I have testified, I am not now certain that 1904 was the date of the revelation to me of the infringement by the Allis-Chalmers Company, but to the best of my memory that was the year in which this took place; and, as far as I now remember, it was the first knowledge I had of infringement, on the part of any manufacturer, of this device.

March 9, 1915, P. M.

XQ. 297. Regarding the device used by the Allis-Chalmers Company, and I believe installed, as you have testified, in Minnesota, were you interested in following up the device so as to find out whether or not it was successful in its operation? And, if so, what did you do towards keeping track of the installation referred to?

A. I secured no information concerning it other than that which I have already testified to, which was given to me by the chief engineer of the Great Northern Power Company, namely, that of a bypass valve moved by the governor inversely to the main gate, which, when governing was completed, would return slowly to its normal position, was installed. As to the mechanical details by which it was affected and the results obtained. I did not enter into this, as I assumed that it would not have been in use at the time the engineer of the company wrote me, if it had not been successful. I made no efforts to secure any further information concerning it, as I considered this sufficient for the establish-

ment of the fact that my patent was being infringed, and that the use of the by-pass of this character was deemed necessary by the engineers of the Allis-Chalmers Company and of the Great Northern Power Company then in a measure confirming my own view of the necessity for such an auxiliary device.

XQ. 298. And how long, to your knowledge, had that device been in use before you first heard of it?

A. I do not know. When I heard of it and wrote the engineer of the power company, my request for information was limited to whether or not such a device was in existence and in operation there, and I made no inquiry as to its age nor the results that were being obtained.

XQ. 299. How did you happen to discover or become suspicious that such a device was being used, before you wrote to the engineer?

A. I am under the impression that I was verbally informed, and I think it was at the Engineer's Club in New York that this information was first given me.

XQ. 300. And when was that?

A. It was within a comparatively short time before I wrote to the Great Northern Power Company. I should say possibly ten days or two weeks.

XQ. 301. And what part of 1904 do you think it was.

A. I believe it to have been either in the summer or early fall. As I have stated, I have no means of now recalling the exact date without reference to

the correspondence between the enginer of the power company and myself.

XQ. 302. Are you sure that it was not earlier than 1904?

A. No; I am not sure that it was not. I have merely given you my belief that, as near as I can remember, it was about eleven year ago.

XQ. 303. Now, your understanding of the construction of that device, what claim or claims of the patent in suit did you consider were infringed by it?

Mr. Blakeslee: Objected to as calling for a legal conclusion on the part of the witness. What is infringed is the patent, and the matter must obviously have been a question of consideration of the subject of the invention, the subject of the patent, and obviously for the witness to attempt to make any post-election at this time is uncalled for. The witness has told what he knew and was informed of the nature of this infringement, and it is not for him to construe the patent legally and apply it to such question of infringement.

A. My memory is that I considered more particularly claims 6 and 7 to be infringed, though I am not now sure whether I considered other claims in the patent to have been infringed.

XQ. 304. By Mr. Westall: Did you consider that the device installed by the Allis-Chalmers Company at Duluth, Minnesota, in 1914, contained within it "a returning device for said controller provided with actuating means controlled by said controlling means to return the controller to inoperative posi-

tion so as to prevent excessive movement of the governor" as disclosed in claim 4 of the patent in suit?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent, and calling for a mere statement of opinion and expression of opinion, and not calling for an expression or statement of facts, not the proper method of proof, the best proof being what the apparatus itself was, and the witness has testified that he had not seen the apparatus; and having given the best evidence he can give as to what that apparatus was, a comparison of it with the subject of any descriptive mechanical language is not the proper method of proof as to what it was or as to what relation there may have been between it and the patent in suit.

A. I did not know anything concerning the details of the governor mechanism itself, except that if it were operative it must have some form of returning device, and at that time I was more specifically interested in the by-pass valve; and if my memory is correct, I did not make any allegation that all the claims in the patent in suit were infringed. Just how many of the claims and which ones I relied on at the time, I do not remember, but I am sure that among these were included claims 6 and 7, and that I had principally in mind the feature covered by these claims.

XQ. 305. By Mr. Westall: You never investigated fully to find out exactly what that mechanism was in order to know whether or not it might be cov-

ered by some of the other claims of the patent in suit, did you?

A. No.

XQ. 306. I show you "Complainant's Exhibit G," and "Complainant's Exhibit J," and ask you if you recognize and understand the operation, function and purpose of the two governors that are illustrated in the exhibits referred to?

Mr. Blakeslee: We object to the question on the ground that there is no foundation laid for it, the witness not having been asked whether he has ever examined these exhibits, which are photographs.

XQ. 307. By Mr. Westall: I simply ask you whether you do understand them, and not to describe them.

Mr. Blakeslee: And the record not showing that he has ever examined them.

A. I cannot say that I understand these exhibits from this examination of them or that I would fully understand them without the aid of some description or mechanical drawings that would illustrate more clearly the parts in their relations. There are, however, a good many of the parts that have a familiar look and apparently are the same as parts on other governors with which I am familiar.

XQ. 308. By Mr. Westall: Do you recognize either of those governors as a Lombard governor?

Mr. Blakeslee: The same objection.

A. I recognize many of the elements of the Lombard governor in them both, and I would believe, without further information on the subject, that

they were made by the Lombard Governor Company.

XQ. 309. By Mr. Westall. How long to your knowledge have governors of that type been made, used and sold by the Lombard Governor Company?

A. I am unable to say. The Lombard Governor Company was, so far as I know, one of the earliest manufacturers of these machines in America; and the general type of governor illustrated in the photograph "Complainant's Exhibit J," illustrates the form of governor, which, with modifications, that company made, for a number of years. The vertical type of governor shown in the photograph "Complainant's Exhibit G," was developed at a considerably later period. Just what the dates were of first placing these two types on the market, I do not know; nor can I even approximate, except that the vertical type was certainly produced at least five or six years after the horizontal type.

XQ. 310. And can you state when you first heard of or saw either of these types of governors?

A. No; it would be impossible. I have known throughout the period of my engineering experience in America, dating from the early part of 1898, that the Lombard Company was making a water-wheel governor; but as to how long they had been making each of these types, I have no idea.

XQ. 311. Would you say that it was as long as ten years ago?

A. I have testified that certainly as long ago as sev-

enteen years ago the Lombard Governor Company was manufacturing water-wheel governors.

XQ. 312. And to your knowledge were they of the same general type as those which are illustrated in "Complainant's Exhibit G," and "Complainant's Exhibit J," which you have before you?

Mr. Blakeslee: We object to this as merely repetitions, the witness having testified that he has no idea as to when these types of governors first came into the market.

A. I know that the type shown in "Complainant's Exhibit G," was developed sometime subsequent to the year 1902. I believe it never appeared before 1906, but I am not sure enough of these impressions to give them as more than impressions. The horizontal type of governor, such as is illustrated in "Complainant's Exhibit J," was the earliest type. I am now referring to the operating mechanism, and not to the speed-controlling device. I do not know, and have not even an impression of the time when the speed-control device was changed to provide for a variable opening of one of the holes in the dashpot, which action I have previously described on direct examination.

XQ. 313. By Mr. Westall: When did you first write to the Lombard Governor Company at Ashland, Massachusetts, regarding the purchase of your patent, the patent in suit?

A. I do not now remember. I do know that it was prior to the removal of that company from Boston, where its works originally were located, to the present works at Ashland.

XQ. 314. Is there any way that you can approximately fix the date of your first writing to the Lombard Governor Company concerning the patent in suit?

A. I have not even an impression of the time further than that mentioned, the reason being that from the date when this invention first took form until I finally sold it to Mr. Henry, I continually offered it in every available direction, and in the case of the Lombard Company, the matter was brought up two or more times, and I know that an interval of some years passed between the first time and the second time; but to locate these times and attempts to sell the patent to the Lombard Company, would be impossible for me now, although I believe the characteristics of the management of that company are such that the correspondence is still on file.

XQ. 315. Do you believe that you took this matter up with them prior to 1904?

A. I am under the belief that I took this matter up with them prior to 1902. I have no surety of it, and I only judge of this by the fact that in the four years that elapsed from the date of my invention in 1898 until 1902, I persistently offered the invention in every direction that seemed to me to be open.

XQ. 316. Was it your contention at the time you first took this matter up with the Lombard Governor Company that the devices they were then making were infringements of your patent or of any of the claims thereof.

A. I think I made no contention of any kind, that I simply laid the subject matter of the patent or the patent application before them and asked that they give con-

sideration to all the features of the invention, and, if they found that these incorporated anything new or valuable to them, that I would be glad to enter into negotiations with them for the disposition of the patent.

XQ. 317. When, if ever, did you threaten suit against the Lombard Governor Company for alleged infringement of your patent or any of the claims thereof?

A. An agent of the Lombard Governor Company was in my office either four or five years ago, showing me some of the new types of governors that had been developed, and I called his attention to the necessity of certain features which the governors very apparently did not have, and he made the statement that these features were going to be added to the then type, and I told him that if they were added that I would bring suit against the Lombard Governor Company. Later Mr. Garratt, engineer and general manager of the Lombard Governor Company was in my office. This I believe to have been about three and a half years ago. And I told him that I felt that unless he purchased the patent which I owned and which is the patent in suit, his company would become liable to me for infringement, and that it was my intention if I could so arrange matters to do so, to bring suit against his company or any other infringers that I might know of. These statements, I believe, constituted my threats to bring suit against the Lombard Governor Company, although it might be that Mr. Messimer also wrote to the Lombard Governor Company at the time I have previously testified about. In the absence of Mr. Messimer's correspondence, I, however, am unable to say definitely about this.

XQ. 318. When did these conversations take place, and when were these verbal threats made that you have described in your last answer?

A. About the times which I have before mentioned, the first one made between four and five years ago, and the second one made some eight or ten months thereafter. I fix those dates by the fact that I was in one portion of the building at 60 Broadway when the agent of the Lombard Company called on me, and I had moved my office to another portion of the same building when I had the discussion later with Mr. Garratt, and it is by a general knowledge of the time that I occupied these two different offices that I am able to roughly approximate the dates of these discussions.

XQ. 319. Have you closely followed the development of the water-wheel governing art since the time of your alleged invention of the subject matter of the patent in suit?

A. I have kept informed on this subject, partly because of my interest in it that would proceed from the patent, and also because my professional practice has required it.

XQ. 320. In threatening the Lombard Governor Company with suit for infringement, what particular features or parts of the patent in suit or what particular claims therein did you have in mind as being infringed by them?

Mr. Blakeslee: Objected to as not cross-examination, and as calling for an interpretation of the patent with respect to the infringement, and not a comparison of structures.

A. I know that claims 6 and 7 were among those

which I brought to the attention of the Lombard Company. I am under the impression that the entire patent, however, was discussed and in the conversation with Mr. Garratt, I believe I was more concerned in pointing out the advantages which would accrue to the Lombard Company by the adoption of the design of my entire governor than the question of infringement, and the whole subject was discussed, although, as stated, I informed Mr. Garratt that I had been informed that his company was making infringing structures and it was my intention to protect whatever rights had been granted me by the Patent Office if I could make proper arrangements to do so.

XQ. 321. By Mr. Westall: Will you please describe the device which at the time of your first threat of suit against the Lombard Governor Company was being manufactured, used or sold by them, and which you conceived to be an infringement of any part or parts or claims of the patent in suit?

A. I do not know the mechanism which the Lombard Company proposed to add to its governors, except that the agent of the company who first called on me informed me of the intention of the company to place automatic inversely operated slow returning by-pass valves on their governors, and I felt that this in addition to the other features of the Lombard structure with which I was familiar, was so clear and obvious a case of infringement that I could induce the Lombard Governor Company to take some action without recourse to the courts. I did not, therefore, consider the relation of the then existing Lombard structure with the claims of my patent, as there

were some of the elements in my complete invention that the Lombard Company had up to that time not made use of, namely, the by-pass valve. After this was added it would be a complete infringement and then, to my mind, it became obvious that the company could then be induced to take some action. I had never seen a Lombard governor with the by-pass valve attached, and I do not now know by what mechanism that company intended to cause the action of such valve, although I have been familiar with the machines of that company for many years.

XQ. 322. You did not consider, then, at the time of your first threat of suit against the Lombard Governor Company that any form of governor which they were then making or had previously made infringed any of the claims of your patent, or would infringe those claims, unless a by-pass was added to the structure of the valve, operated inversely to that of the water gate, as described in claims 6 and 7 of the patent in suit. Is that correct?

Mr. Blakeslee: Objected to as placing an improper construction on the testimony of the witness, to which reference is made, and that it is misleading in that respect.

A. As to my state of mind concerning the relation between the machines as then made by the Lombard Governor Company, and the construction called for by the patent in suit, I cannot now say. I know that I did not consider that I had a clear and absolute case against the Lombard Company, which, in itself, was so obvious that I could obtain settlement from them without going to the courts, until they had completely infringed all the

conditions of the claims of the patent in suit. This, however, was my own judgment in the matter, which may or may not have been correct.

XQ. 323. By Mr. Westall: At or prior to the time of your first threat of suit against the Lombard Governor Company, had you had the advice of any patent attorney concerning alleged infringement of any device or by any device of your patent?

A. I have never had the advice of any patent attorney as to whether or not any structure infringed the claims of my patent. I had a superficial familiarity with the general terms of patent claims, and what they described, and felt that I was able to form a conclusion as to infringement. As to the wisdom of any such view, I am unable to say. This, however, was my view, and I acted on it. But I have never had any patent attorney take my patent which is the patent in suit, and compare it with some existing structure and from this comparison advise me as to whether such existing structure infringed the claims of my patent, and if so, at what point and in what manner.

XQ. 324. Were you well informed as to the different kinds of governors the Lombard Governor Company was making prior to the time of your first threat of suit against them?

Mr. Blakeslee: Objected to as merely repetitious.

A. I was thoroughly well informed on the subject of the construction of Lombard governors, as I have before testified. In common with every other company, the product of this company has progressively been improved. The knowledge that any engineer has of the product of a certain company is usually sporadic. If an

engineer has a water-power plant to construct at one time, he then thoroughly investigates all the existing governors, or, at least he should do so. After making a selection, it may be two years or three, or possibly longer, before he has another water-power plant to construct in which it is necessary for him to use governors. He then again examines all the governors on the market, because within that period of time considerable changes may have been made not only in the art, but in the structures of the manufacturers engaged in the business. So for this reason the knowledge of any engineer, unless he is continually engaged in one specific branch of the art, is thorough and definite only at intervals, so that in the course of a number of years he has a knowledge of the various machines and the development they have passed through; but this knowledge has not continuity.

XQ. 325. By Mr. Westall: When did you first bring the device of the patent in suit to the attention of the Pelton Water Wheel Company of San Francisco in an endeavor to interest them in the purchase of the patent in suit?

A. I cannot say. My memory is that in 1904 I communicated with the Pelton Company and sometime again in 1907 or 1908 I called at the New York office of the Pelton Water Wheel Company and stated to Mr. Kunze, the manager of that office, that I had been informed that the Pelton Water Wheel Company was engaged in the manufacture of governors, and, further, that the structures made by his company were infringements of my patent, and I made a request that he take the matter up with the home office and see if we could not enter into some business negotiations covering the situation.

XQ. 326. Your first communication with the Pelton Water Wheel Company in 1904, in what form was that communication?

A. I believe it to have been in the form of a letter to the company.

XQ. 327. And what was the subject matter of that letter?

A. If I remember correctly, it simply called the attention of the company to my invention and suggested that it might be of interest to them. At that time, so far as I know, the Pelton Water Wheel Company was not engaged in the manufacture of governors.

XQ. 328. What reply did you receive from the Pelton Water Wheel Company to that communication?

A. I do not remember. It is my belief that the reply indicated that the Pelton Company was not interested in manufacturing governors, and did not intend to become interested in their manufacture, but I am not sure on that point.

XQ. 329. I wish you would give as near as you can the exact date of your conference with Mr. Kunze of New York—the New York manager of the Pelton Water Wheel Company—regarding the patent in suit.

A. That it would be impossible for me to do, and I do not recall any other event or any document to which I could relate the circumstance. I believe the interview to have been held in the office at 90 West Street, New York. Therefore, it was subsequent to the construction of that building, and this is the only factor that would limit it as to the distance in the past.

XQ. 330. Could you give approximately the year?

A. I can simply limit it. I know that it was not prior

to 1906, and I know that it was not later than 1910. I have no way of bringing these limiting periods closer together, except as a general impression that it was 1908. I wrote so many letters and made so many efforts to dispose of this patent, that it is almost impossible for me to separate out any individual case, unless there is some collateral circumstance that would have fixed the date in my mind.

XQ. 331. Did you at that time threaten the Pelton Water Wheel Company with suit for alleged infringement of your patent or any part or claim thereof?

A. I remember telling Mr. Kunze that if his company was making governors which infringed my patent it was my intention to seek redress in the courts unless some business arrangements were made between the Pelton Company and myself.

XQ. 332. And what was your theory or idea regarding the bringing of a suit against the Pelton Company? That is to say, what part or claim of your patent, if any, did you conceive to be infringed by any structure that they were then or had theretofore been making?

A. I had not at that time ever seen a Pelton governor, and the only way in which I concluded that the Pelton Company was infringing my invention was from either a statement made to me of some article in a technical journal, which I cannot say, that indicated an infringement of the patent. I do not remember the details that would cover all the infringement, except I distinctly remember that one of the features was the by-pass valve as covered in the patent. What other features, if any, I was informed on, I do not now remember. But I am sure there had been

a sufficiency of statements made to indicate an infringement of the patent. That there was any such infringement was later denied by the Pelton Company.

XQ. 333. Do you remember the form in which this denial of infringement was communicated to you by the Pelton Company?

A. I believe that it was made to me verbally about a week after my first call on Mr. Kunze, or possibly a later time when I made a second call to inquire as to the result of my first interview with him.

XQ. 334. Were you acquainted or did you know of Mr. George J. Henry, Jr., the complainant in this case, at any time that you were conducting negotiations with the Pelton Water Wheel Company concerning your patent?

A. No; I did not. I was not personally acquainted with him, and did not even know of him.

XQ. 335. Did you know at that time that he was connected in any way with the Pelton Water Wheel Company?

A. No. I never knew until within the past four days that Mr. Henry had been at one time connected with the Pelton Water Wheel Company.

XQ. 336. Did the Pelton Water Wheel Company in the denial of the infringement which you have described state any reasons why they thought they did not infringe upon your patent? And, if so, what were those reasons, if you recall them.

A. I do not remember that any reasons were given. My memory is that the statement was simply that the matter had been referred to the head office of the Pelton

United States
Circuit Court of Appeals
For the Ninth Circuit

Transcript of Record

GEORGE J. HENRY, Jr.,
Complainant.

vs.

CITY OF LOS ANGELES,
Defendant.

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(Pages 2001 to 2400 Inclusive)

Upon Appeal from the United States District Court for
the Southern District of California,
Southern Division

Company, had been submitted to either their engineers or their patent attorney, or some person whom the officers of the Pelton Company considered competent to judge, and that this party had reported that the governor made by the Pelton Company did not infringe claims of my patent.

XQ. 337. Was it your understanding or belief at the time you made this threat, sometime between 1906 and 1910,—probably 1908—that the Pelton Water Wheel Company was using a by-pass controlled by a by-pass valve operated inversely to the water-wheel gate?

A. I understood that that was one of the features of the governor which that company had developed.

XQ. 338. Please state how extensively to your knowledge a by-pass controlled by a valve operated inversely to the water-wheel gate, as described in your claims 6 and 7, has been used by various manufacturers since the grant of the patent in suit?

A. I cannot say, except that I know that only a small percentage of the governors in use in the eastern states is supplied with the by-pass arrangement. Just what the conditions are on the Pacific Coast, I do not know; but I have been given to understand that the use of the auxiliary by-pass is frequent. Of course, the conditions of power development make a difference in this respect. Where water wheels are set in open penstocks, as is almost universally the case in water-power developments up to 30 or 35 feet head, the by-pass can serve no useful purpose, and it has its application only where the turbines are completely inclosed and are supplied with water through a pipe or penstock of appreciable length.

So many of the water-power developments in the East are low head developments that there would naturally be but comparatively few by-pass valves used, even if there were no limitation on the manufacturers to place them.

XQ. 339. After your first knowledge of the use of the by-pass by the Allis-Chalmers Company in 1904, how extensively did the Allis-Chalmers Company use that device after that date?

A. That I do not know.

XQ. 340. When did you next hear, after 1904, of the use of a by-pass valve operated inversely to the water-gate valve, as described in claims 6 and 7 of the patent in suit?

A. I think it was 1906 or 1907.

XQ. 341. Please state the circumstances of that use and your knowledge thereof.

A. A description of some plant in the West, I believe in California, the machinery for which was supplied by the Abner Doble Company, was described in one of the technical journals, and among other features was a by-pass valve operated inversely to the main or water-gate valve. I do not now recall where the plant was located. I simply remember the manufacturer.

XQ. 342. Did you take up with the Abner Doble Company the question of the purchase of your patent or did you protest against the use of this device in the plant which you have mentioned in your last answer?

A. I think that I never communicated with the Doble Company on this subject. It was located too far away, and I was at that time attempting to get some arrange-

ment with other companies, believing that if the patent were taken over by one of the other companies that the very fact that additional infringers had begun the manufacture of this apparatus would be proof to the companies with whom I was attempting to reach a business conclusion, that the device offered had not only one but several elements of value. It was my understanding that unless I could compel some infringer who was more accessible to me to take some action which would be satisfactory, that under the circumstances it would be hopeless to compel one as far removed from my location as the Abner Doble Company, particularly if there were infringers in the East, of which the Doble Company would probably have information. I therefore set that knowledge aside in the expectation that it could be used at some future time.

XQ. 343. You have spoken of infringers in the East. Please mention the companies which at that time you considered to be infringers of your patent in the East.

A. I considered the Allis-Chalmers Company an infringer; I considered the Pelton Water Wheel Company an infringer, which, though not an eastern concern, did a great deal of eastern business; I was informed that the I. P. Morris Company was preparing to market a governor which would have been an infringement of my patent, and I notified it also of this fact. It was subsequent to the disclosure of the infringement of the Abner Doble Company that the complete infringement of the Lombard governor was disclosed to me. I do not now remember any others that were infringers, or whom I

knew to be infringers, of the complete structure as disclosed in the patent, at or near the time that this article describing the plant supplied by the Abner Doble Company came before me.

XQ. 344. Do you recall what plant it was that was supplied by the Abner Doble Company that you have heretofore mentioned?

A. I do not. I believe that the description appeared in one of the bulletins of The American Society of Mechanical Engineers, and that a reference to the transactions of that Society would disclose the date that it came before me. But what the structure was and, further, where the plant was located, I do not now remember.

XQ. 345. As an engineer were you interested in the project of the Los Angeles Aqueduct, and did you follow the development of that to any extent?

A. No. It was a class of engineering construction that was somewhat removed from the lines which I follow, and, while I knew that the Los Angeles Aqueduct was being constructed, because of frequent references to it in the technical journals, that was the extent of my knowledge, as I never read the articles describing it and never knew anything of its character or magnitude until some time ago when one of the pipes forming a portion of a siphon, collapsed; and as this question of collapse of large water pipes is one that I had given a considerable amount of study to, and had been investigating for some years, this interested me. But not until then did I learn anything concerning the Los Angeles Aqueduct.

XQ. 346. About when was it that you first became

then interested in any feature of the Los Angeles Aqueduct?

A. My memory is that it was about a year ago. A reference to the files of the Engineering News, which journal conveyed to me the information of the failure of this pipe by collapse, would show exactly the date.

XQ. 347. Were you interested in any way in ascertaining the method of governing of the water wheels of any of the plants along the line of the Los Angeles Aqueduct at any time?

A. No. I never knew until my arrival in Los Angeles on the 4th day of the present month that there were any power plants on the Los Angeles Aqueduct, it having been my impression up to that time that the supply of water to the municipality for ordinary domestic uses was the entire function fulfilled by this construction.

XQ. 348. So that you never heard of either of the hydraulic plants which are involved in this controversy, before coming to Los Angeles?

A. No.

XQ. 349. When did you first become acquainted with Mr. George J. Henry, Jr., the complainant in this suit?

A. Personally?

XQ. 350. When did you first open negotiations or get into communication with Mr. Henry?

A. I do not remember. I think it was in the year 1912.

XQ. 351. Might it have been as late as 1913?

A. It might have.

XQ. 352. Could you swear positively that it might not have been 1911?

A. I could not; but my impression is very definite that it was subsequent to 1911.

XQ. 353. Please state the circumstances as fully as you can, together with the time and place of your first communication with Mr. Henry concerning the patent in suit.

Mr. Blakeslee: We object to this question as needlessly encumbering the record, incompetent, irrelevant and immaterial. Testimony has been introduced when the patent in suit was purchased by Mr. Henry, the complainant, from the witness, and it cannot be material how long the witness has known the complainant and it cannot affect the issues of the case in any manner.

A. As for the time, I can only fix it as being subsequent to the dissolution of the firm of Duncan & Lyndon, and my removal of my offices to the Knickerbocker Trust Building at 60 Broadway, which took place in 1910. The communication was in the form of a letter from Mr. Henry asking me if I was still owner of the patent in suit, and, if so, at what price I would sell it. I replied to this naming a certain price and conditions, and this, I believe, was the first time I ever had any communication from Mr. Henry on the subject.

XQ. 354. By Mr. Westall: Will you please state the price and conditions which you offered Mr. Henry the patent for?

Mr. Blakeslee: Objected to as not the proper method of proof, not the best evidence, the negotiation between the parties having been reduced to a written instrument

which is in evidence, being an assignment from the witness to complainant, and this documentary evidence being the best evidence as to the culmination of this transaction, and that this is irrelevant, immaterial and incompetent.

A. I named a price of \$7500 cash payment and a royalty, the amount of which royalty I now do not remember. But the payment of royalties based on the quantity of business done in the sale of structures made in accordance with the patent in suit was to continue throughout the life of the patent.

XQ. 355. By Mr. Westall: What response or reply did you get to that offer?

Mr. Blakeslee: The same objection.

A. I do not remember either the date or the form of any response to that letter. In substance, Mr. Henry declined to purchase the patent on those terms.

XQ. 356. By Mr. Westall: Did Mr. Henry at that time make you a counter-offer?

Mr. Blakeslee: Objected to on the same grounds.

A. I do not remember that he made a counter-offer.

XQ. 357. By Mr. Westall: What further negotiations did you thereafter have?

Mr. Blakeslee: The same objection.

A. Some time after this first correspondence, Mr. Henry wrote me and called my attention to the fact that the patent had not many years to run and that in spite of my efforts to place it I had not been successful, and he suggested that if I were willing to take a very reasonable price for it that he might be able to purchase it. I at that time had no other prospect for its use, and had

come to the conclusion that without capital to enforce such rights as had been granted me that I could not make this patent remunerative to me, and I therefore named a merely nominal figure, which Mr. Henry accepted.

XQ. 358. By Mr. Westall: Will you please state what that figure was?

Mr. Blakeslee Objected to on the same grounds, as not the best evidence, the assignment in evidence last referred to being the best evidence.

A. \$2500.

XQ. 359. By Mr. Westall: What were the terms of payment of that sum of \$2500?

Mr. Blakeslee: The same objection.

A. It was substantially a cash payment. It, however, was made in two payments, owing to a misunderstanding between Mr. Henry and myself, and I think those two payments were separated two or possibly three weeks apart until correspondence passed between us. But to all intents and purposes it was a cash payment.

XQ. 360. By Mr. Westall: And was that sum of \$2500 paid substantially as agreed by Mr. Henry?

A. Yes, it was.

XQ. 361. And have you received at the present time all of the consideration for the sale of the patent?

A. Absolutely every cent.

XQ. 362. Was there any arrangement made at that time whereby you were to produce evidence of the date of your invention before the passing of any consideration?

A. The only arrangement was that I should furnish

Mr. Henry with affidavits of persons to whom I had disclosed this invention at the time it was made; but there was no arrangement regarding any testimony by myself, if I understand your question, on the subject.

XQ. 363. And when did you furnish those affidavits and those sketches or drawings? Was it before or after the contract of purchase was entered into between you?

Mr. Blakeslee: Objected to as not the best evidence. The affidavits speak for themselves and the assignment speaks for itself, and the papers could manifestly not have been furnished prior to the date of the annexed affidavit.

Mr. Westall: It might be proper to call counsel's attention, as he has on one or two occasions himself done, to the rule which prohibits argumentative objections.

Mr. Blakeslee: Counsel for defendant apparently does not understand the difference between an objection with ground given and an argument based upon an objection. I am merely stating the grounds of the objection as conforms with the rule.

A. If I remember correctly, the contract of purchase was made prior to the securing of these affidavits. It was understood between Mr. Henry and myself, whether in the agreement or whether in a letter which was one of the communications between us, I can not say, that I would furnish him affidavits of date of invention. But I believe these were supplied subsequent to the agreement. My transaction was not directly with Mr. Henry after the first few communications, but with Messrs. Prindle & Wright, his attorneys, in New York, and they of course, acted for Mr. Henry's best interests and

made an effort to secure even better terms than Mr. Henry and I had practically agreed on, and it was through them that the \$2500 was paid.

XQ. 364. By Mr. Westall: What arrangements did you make at that time for appearing as a witness in this case?

A. None whatever.

XQ. 365. Were you informed in any way that you would be required to testify?

A. Not until I received a telegram from Mr. Henry about two weeks ago asking me if I could appear and if I would. I want to say though, that prior to that time, after this transaction, I wrote Mr. Henry at the time that I got up some old correspondence on this subject for him, that if he at any time would require any testimony, in view of the fact that I was in Austin, Texas, so frequently, I, of course, would be glad to give testimony. But as I remember, he never replied to this suggestion, and I never had any intimation from him that he would desire to have me testify until the receipt of this telegram.

XQ. 366. So that any arrangement that you may have now for compensation for your services and time in coming out here to testify is entirely disconnected with the original agreement made for the purchase of the patent?

A. Entirely; it has no relation to it, and under the agreement I was and am under no obligation to testify in this case.

XQ. 367. Now, you have stated that at no time since the granting of the patent have you felt that you

could spare \$3,000 to enter into litigation against alleged infringers of the patent. Have you at any time prior to the sale of the patent to Mr. Henry been able to spare \$2500, with a little sacrifice, in order that the suit for infringement might be instituted?

Mr. Blakeslee: Objected to as needlessly encumbering the record and prying into the private affairs of the witness. We will insist that the witness has testified that at no time while he owned the patent in suit was he sufficiently financially equipped to start an infringement suit and prosecute it to a finish. As before stated, there is no standard of measurement of the cost of a suit, and this evidence is, as far as the question can be put in fairness to the witness, without inquisitively seeking to pry into his personal affairs.

A. I do not believe that at any time I would have been able to furnish \$2500 in cash for this purpose, and if I had been able I would have regarded it as so totally inadequate that I would not have attempted to bring a suit against any great corporation, with its resources and staff of patent attorneys, with such a small fund to do it.

XQ. 368. By Mr. Westall: Have you at any time during your ownership of the patent been able to spare even with a little sacrifice the sum of \$2000 in order to institute and prosecute a suit for infringement?

Mr. Blakeslee: The same objection. We notify counsel for defendant that if he persists in this useless, frivolous and time and space wasting inquiry, we shall move to have the cost of taking and returning the cross-examination of this witness taxed to the defendant.

A. While willing to testify in any manner and in answer to any question that bears on this subject, it appears to me that in view of my statement that I did not have ever an amount of money which I regarded as in any way adequate to bring suit to sustain the validity of my patent, that the possession of any lesser amount would hardly bear on the matter in any manner. And while I have nothing to conceal in regard to my own private affairs, I judge that when they have disappeared from possibility of relationship to this suit they become specifically my private affairs, and, for this reason I prefer not to make a specific reply to the last question, unless instructed by counsel to do so.

Mr. Westall: I would state for the witness's information that the question is not asked for the purpose of prying into his private affairs, but simply to make most specific on a very vital issue in this case the general financial conditions which have been made on direct examination.

Mr. Blakeslee: It does not make any difference whether counsel intends to pry into the witness's private affairs or not. The fact remains that he is prying into them. That the witness having testified that he at no time had money which satisfied him would be sufficient to carry through this suit, that is, money to apply to this purpose, the inquiry is satisfied so far as it can properly go. For, as we have stated before, there is no standard by which counsel can hope to establish the fact whether \$1,000 or \$20,000 would have been sufficient for the purpose. The question is, therefore, wholly irrelevant, and the inquiry is futile for any purpose of proving any issue in this case. It might properly have been

that the witness considered that \$20,000 would not have been sufficient for the purpose mentioned, and the inquiry can go no farther than what the witness considered would be a proper amount. And as to that, he has fully answered.

A. In further amplification of my answer, I would say that I have known considerable about patent suits, their extent and their cost; and with the knowledge which I possessed, I would not have undertaken to bring this patent into court with less than \$6,000 in cash on hand which I could devote absolutely to this purpose. And, as I have testified, I have never seen the time when in my judgment I could spare even \$2500 for this purpose.

XQ. 369. By Mr. Westall: Do you mean to say by your last answer that you might have spared \$2,000 for this purpose, if you were satisfied by reason of any peculiar circumstances that the \$2,000 would have been sufficient to prosecute the suit?

Mr. Blakeslee: The same objection, and the further objection that the question has already been fully answered. And we repeat our objection to encumbering the record with this foolish line of inquiry.

A. That conclusion cannot be deduced from what I have stated, nor have I stated that I at any time had even as much as \$2,000 that I could have devoted to this suit, nor have I indicated that at any time have I had as much as \$1,000 or even \$500 that I could have devoted to this purpose. Whether any one of these sums might have been obtained by me for the purpose, I would not have considered it advisable to embark in the litigation without more than any one of these amounts.

XQ. 370. By Mr. Westall: Is this because in your opinion your patent was of such doubtful validity, or was it because you feared that you could not prove infringement?

A. It was neither of these. It was the fact that such cases as I knew of were often prolonged over such lengths of time that no matter how clear the question of validity or infringement might be, it no wise followed that I would obtain a judgment within what might be considered a reasonable period of time, which further meant that in addition to the payment of all the disbursements and costs incurred I would be obliged in a considerable measure to neglect my practice, which, as I say, was my only source of income, in order to prosecute any litigation. In other words, whether my judgment was correct or not, it was to the effect that without enough money to prosecute the case and to decline to take certain engineering commissions, and in the meantime, to meet all my necessary expenditures, that it would be impracticable to fully and thoroughly prosecute any suit for infringement, and it was not my intention to enter into anything that I could not see brought to a finish. These statements, I think, cover fully the question of my inability to compel a recognition of the rights which I acquired under this patent and to force infringers to make proper and compensating business arrangements for the use of the device covered in the patent.

XQ. 371. It was then not solely not being able to raise the necessary money, but other considerations, such as your professional duties, and also the question of policy as to whether it would be wise for you to go

into litigation with any of those big concerns who might be the means of your receiving commissions that restrained you from beginning suit against any of the alleged infringers of your patent. Is that correct?

A. Only partially. The whole question was one of sufficient funds. The necessities which you mention of continuance of professional work were those which arose from the necessity of my continuing to procure enough money to subsist on and meet the necessary expenditures that every man has. If I had had a sufficient sum of money to prosecute the case properly and to give the amount of time to it necessary, I should certainly have done so; and in the absence of either one of these factors, I realized that the expenditure of any sum which would be inadequate would likewise be futile. But, in the last analysis, it was always a question of a sufficient amount of money only.

XQ. 372. If you had been furnished with the sum of \$6,000 and your other circumstances had remained the same, would you have embarked upon litigation against any of these various infringers? Or would you have found some other and more profitable use for the money?

A. I feel sure that I would have brought suit against the infringers, and I would have felt equally sure that I would not have found a more profitable use for the money, because I have always felt in my own mind that the patent was valid and that I was a pioneer in the art, and this impression was so strong that I have never felt that the final issue in court could be doubtful if it could be brought to an issue. But, if you will recall, I have testified that I have seen and had at that time considerable experience with patent suits and had a knowledge

of the conditions under which they had to be brought and maintained. You will understand fully how clear it was in my mind that an adequate sum and ample time were both necessary to sustain even the patent in which I had as much confidence as I have expressed myself as having in this one.

XQ. 373. It is true, is it not, that prior to your invention, manually operated means for permitting water, the use of which was not desired at the wheel, to flow around the wheel, or to be by-passed without acting on the wheel, was known, and had been used?

A. I am not sure about this. I believe that to have been true, but what the form of mechanism, where it was located, or in what condition it operated, I do not know.

XQ. 374. At the time of your invention had you ever known of a by-pass being used to maintain a constant flow of water in a penstock, manually operated, or otherwise?

A. No. The invention was absolutely original with me.

XQ. 375. Did you explain fully to Mr. Meyer in the conversation at the restaurant in New York, in 1898, your provision for maintaining constant flow in the pipe-line by the use of a by-pass?

A. No, because it was never my intention to have a constant flow in the pipe-line, and neither my invention nor patent calls for such a condition.

XQ. 376. What did you explain to Mr. Meyer, if you recall, at that time, in relation to the purpose and function of the by-pass?

A. I explained to him that when the water-wheel gate

would be moved, say in a direction to close, if there were no compensating means and the gates of the water wheel were closed quickly, the energy in the mass of water in the pipe-line could not be instantly retarded to accord with the new position of the water wheel gates. For a few instants, therefore, the condition of a diminished opening, but the same quantity of water passing through this diminished opening at a higher velocity, would result. The velocity of the water wheel is dependent not only on the quantity of water entering, but also partly on its entrance velocity. Hence, for these first few instants there would be substantially the same quantity of water as had passed through the gates before their partial closure ^{at a higher velocity so that instead of} ~~of the water-wheel gates is made by a rapid~~ diminishing the speed of the water wheel, which would have been the object of partially closing the water-wheel gates, the speed for these first few instants would actually increase and then begin to decrease, as the body of the water in the pipe-line gradually decreased in velocity, which decrease in velocity would come from the partial choking effect, due to the smaller opening of the water-wheel gates. With a by-pass arrangement a partial closure of the water-wheel gates is made by a rapid opening of the by-pass valve, so that the total area of the openings through the penstock is not greatly diminished, and not diminished in anything like the same ratio as that area would be diminished without the by-pass. This action, of course, allows, during the short period of governing, a considerable flow through the by-pass. The next step in the process of governing is to prevent the flow of the water from being any greater than necessary to supply the turbine and at the same time to cause

this prevention to be distributed over such a length of time that the velocity of the mass of water in the pipe is gradually retarded. This is effected by permitting the by-pass valve to return towards its closed position, thereby shutting off the passage of water or partially shutting it off, through the by-pass. But the rate of motion of the by-pass valve must be slow enough to allow a gradual retardation of the velocity of the column of water in the pipe, so that no excessive velocities of water through the water-wheel gates take place. The length of time required for the by-pass valve to return slowly to its normal position, which means, of course, the length of time required for the retardation of the velocity of the water in the pipe, is comparatively very great as related to the length of time to open or close the water-wheel gates if good regulation is to be given. That is, the water-wheel gates must very quickly respond to changes in load. The water column cannot quickly respond to changes in load. There must be a time element in the change of the velocity of the water in the pipe, and that time element is transferred from the water-wheel gates to the by-pass and by-pass valve. It was the combination of these physical phenomena and the methods of obtaining good governing in spite of the difficulty produced by the inertia of the water column, that I explained to Mr. Meyer and illustrated in the sketch which I made for him.

XQ. 377. Did you at that time explain to Mr. Meyer any of the provisions for adjusting the by-pass valve so that it might occupy, under normal conditions of speed and load, either a half-open position or a closed position, or any intermediate position?

A. I do not remember, but it is my impression that I did not discuss that specific feature with Mr. Meyer at that time. My reason for this belief is that the disclosure was made to him at lunch and we did not have a considerable time to give to this meal, and I had previously disclosed to him the speed-control device and the returning device, and it was on Mr. Meyer's suggestion that the rapid velocity of gate movement which I was attempting to produce would set up comparatively high pressures of, it might be, under certain conditions, partial vacuum in the pipe-line, that this idea at that time occurred to me; and I remember that it occurred to me instantly and I sketched it out, indicating that the by-pass valve would be in a partially open condition. I think that it was not until I discussed the matter later with Mr. Thorburn Reid—

XQ. 378. (Interrupting) At what time?

A. My memory would fix it as within from ten to fifteen days. I am sure from certain collateral circumstances that it was within sixty days' time after I first made the sketch for Mr. Meyer.

XQ. 379. After the restaurant talk in June, 1898?

A. Yes.

XQ. 380. By Mr. Blakeslee: June or July?

A. Yes; June or July. It is my present memory that in a discussion with Mr. Thorburn Reid he called attention to the fact that my system of governing would only be available in a plant where the water supply would be always in excess of the demand for water for power purposes. It was after thinking on this for a short time that it occurred to me that the by-pass valve could be set for its normal position in the half-open and half-

closed position during the period of the year when there would be an ample supply of water, and in periods of low water it could be adjusted so that its normal position would be closed, and it would then operate in a direction to open when the water-wheel gates were closed. This point I discussed with Mr. Reid after I had given it some thought, and, I believe from this answer something occurs to me which will enable me to fix the time. At the time I was discussing this with Mr. Reid, he showed me a design he had just made for the American Impulse Wheel Company, in which four impulse wheels were fastened on one shaft, and he had arranged the governing so that on full load the governing would take place on one nozzle only. When the load would drop below full load and between fifty and seventy-five per cent load, one nozzle would be closed and three nozzles operating, and the governing taking place on the second nozzle only; and so on, through the four wheels mounted on the one shaft. It is possible that Mr. Reid from this statement will be able to fix the time of my conversation with him about having the by-pass valve completely closed during periods of low water, or closed during the whole year in the case of governing plants where the demands for water for power would always be equal to the quantity of water available.

XQ. 381. By Mr. Westall: You considered this feature of this adjustment of the by-pass valve as an important feature of your invention, didn't you?

A. I am not sure as I regarded it as particularly important, in that the provision of the by-pass for the butterfly valve, which admitted of any kind of adjustment,

seemed to me at the time to be one of the most important features, and the question of adjustment of that valve to one position or the other did not appear to me important, as far as the invention might go, because it, to my mind, would be an obvious thing to adjust an adjustable valve to accord with the conditions which might be encountered wherever it would be installed.

XQ. 382. Now, in the conversation with Mr. Meyer in the Westchester restaurant in New York in June, 1898, do you recollect distinctly the kind of a bill-of-fare they had at that time? Was it a two-sheet bill-of-fare in a binder, or was it simply a card?

A. It was a card. It was of a pinkish color, and it was about 5 by 7 inches, I should say. It is not that I specifically remember this card, but that this form of menu card was standard at that restaurant, and for nearly a year we habitually went to lunch at this restaurant.

XQ. 383. Was it printed on both sides?

A. No; only on one side.

XQ. 384. And this sketch that you made and that you have attempted to reproduce from memory, "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketches of June and July, 1898," was made, as you recall, on the back of that bill-of-fare?

A. Yes; a sketch to which this is as similar as my memory and knowledge of my methods of making sketches has permitted me to produce.

XQ. 385. Now, have you any very positive and distinct recollection that you did make such sketch on the back of that bill-of-fare, or might you possibly be mistaken?

A. That the sketch which I made on the back of that bill-of-fare is similar to this sketch I not only do not remember, but I do not believe it to be exactly similar. That the sketch which I made on the back of that bill-of-fare fully disclosed every one of these elements I know and remember positively.

XQ. 386. And are you sure that you did make it on the back of the bill-of-fare, or might you have made it on some other paper?

A. I am sure that I made it on the back of the bill-of-fare, but I am under the impression that in the attempt to explain it that other and additional sketches were made, as was our custom at times, on the tablecloth or the napkins.

XQ. 387. You have also mentioned the margins of newspapers as possible places upon which sketches were made during the course of your conversation with Mr. Meyer in the New York restaurant in 1898.

A. It is highly improbable that any such sketches were made on the margins of newspapers. It is not impossible, but I should consider that it was very improbable, because it is not customary for business men in the down-town district to have newspapers with them at the lunch hour.

XQ. 388. Now, are you satisfied that this sketch, "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," if such sketch were made in substantial accord with the exhibit referred to on the back of the bill-of-fare in the restaurant in 1898 at the time of your conversation with Mr. Meyer, was sufficient for a technically trained man

of Mr. Meyer's attainments to fully understand the purpose and operation of the device?

A. I considered it so. I would consider that sketch ample to show fully, together with sufficient explanation that would accompany it and accompany the making of it, all of the elements which I disclosed to Mr. Meyer and which I then had in mind, with the understanding that the sketch as first made did not contain the by-pass valve nor by-pass, that being added after the conversation with Mr. Meyer and after an explanation to him of the other portions as indicated in the sketch.

XQ. 389. You have no recollection, have you, as to whether or not those devices were actually added at that time to the sketch you had previously made on the back of that bill-of-fare, or do you simply have the impression that they were very likely to have been made?

A. I know that I made a sketch showing the by-pass and the by-pass valve. It is possible that instead of adding it to the sketch then made that it was sketched on another card ^{or} on the tablecloth, simply showing that portion as separated from the rest. (The witness points to the by-pass and by-pass valve on the sketch.)

XQ. 390. If the sketch had been as complete as you have made it here in "Complainant's Exhibit Reproduction Sketch of His Disclosure Sketch of June and July, 1898," would it have been necessary to make other sketches on perhaps the margin of newspapers or on the tablecloth or on napkins or perhaps on another card, as you have suggested in your last answer?

Mr. Blakeslee: Objected to as incomplete, there being no designation in the inquiry as to the purpose of such alleged necessity.

A. It might have been.

XQ. 391. By Mr. Westall: And do you think that with this sketch exactly as it now appears on "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," if it had been placed on the back of the bill-of-fare in the Westchester restaurant in June, 1898, the time of your conversation with Mr. Meyer, that, in order to make your meaning clear to him it would have been necessary to make other sketches in addition to the one referred to?

Mr. Blakeslee: The same objection.

A. Not necessarily. In order to make my meaning quickly clear to him, it might have been necessary. It is usually a more rapid process to make a simple sketch than to enter into an explanation of a mechanical or electrical device. There are portions there (i. e. in the sketch) which are missing. For instance, the spring for returning the rod and disc of the returning device are not shown, and the sketch there shows a very short rod with no room to place the returning springs on it. These, in my mind, were understood as to be placed there just as is common in so many mechanical devices. It might be that Mr. Meyer, these being all surmises, inquired as to how that rod would be returned, and I might have made a sketch showing the returning springs. I do not say that this actually happened. I merely point it out to illustrate how additional sketches might have been made, in order that within the short time that we had together on this particular day I could have conveyed to his mind clearly any point that might not have been clear from the sketch.

XQ. 392. By Mr. Westall: At the time you made

that sketch you did not mark it with the names that appear on "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," did you?

A. I did not.

XQ. 393. So that it had no written words or printed descriptive words on it at that time that you remember.

A. No; it did not. I not only remember that it did not, but I would know that in accordance with my general habit in making rough explanatory sketches, it would not have carried any wording on it at all.

XQ. 394. It is true, is it not, that you had not figured out all the details by which your principle was to be incorporated into an actual working device at the time of your conversation with Mr. Meyer in the Westchester restaurant in New York in June, '98?

Mr. Blakeslee: Objected to as indefinite and calling for a mere conclusion as to construction and not for a statement of facts as to what details were inquired for.

A. I don't remember whether I had any of the details clearly worked out in a manner suitable for incorporating them into even an experimental machine. It is probable that the details of the controlling mechanism had been worked out, but this I do not know to have been true. I do know that the details for operating the by-pass valve were not worked out, because the idea only came to me at that time and I had in mind only an inverse working by-pass valve; and the method by which it could be made to move inversely to the water-wheel gate and return slowly to its normal position, I had not thought out, as, in the first place, there was not sufficient time at this interview, and, in the next place, it did not

occur to me as important, because there are so many mechanical movements and contrivances available for accomplishing just such purposes. This latter statement is evidenced by the later sketches and blueprints showing the evolution through which that machine passed before it ever reached the point of actual construction.

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XQ. 395. Did you at the time of your first disclosure to Mr. Meyer in the restaurant in 1898 explain to him the kind of valve you would use for either the water gate or the by-pass?

A. I did not explain to him the kind of valve that would be used for the water gate, as that was beyond the scope of my invention. The invention related to the moving of water gates in turbines and water wheels that would be supplied by the makers of these devices and, therefore, the governor which I invented would be called on to move many different types of water gates, depending on the make of water wheel to which the governor might be applied. I did sketch out and show Mr. Meyer the butterfly valve in the by-pass.

XQ. 396. Is this Mr. Henry C. Meyer, Jr., to whom you made these disclosures in the restaurant in 1898 still living?

A. He is still living and in general consulting engineering practice in New York.

XQ. 397. How long has it been since you were last in communication with him?

A. I believe I saw Mr. Meyer in July, 1914, last.

XQ. 398. Have you had any correspondence or communication with him concerning any of your alleged

disclosures to him in June or July, 1898, in the restaurant in New York, as described by you?

A. I do not recall any written communication which passed between us. I have spoken to him in person about this disclosure.

XQ. 399. And did you at that time reproduce any sketches or discuss with him in detail the circumstances of any such conversation or disclosure to him in June or July of 1898 such as you have described?

A. I do not recall that I made any sketches. The character of my conversation with him on this subject was to inquire if he remembered the circumstance of my having made the disclosure of certain parts of my invention, and to have invented certain other parts in his presence at the time of making those disclosures.

XQ. 400. You say you do not recall having made any sketches. Might you have made sketches which you cannot now recall?

Mr. Blakeslee: Objected to as frivolous and impossible of answer within the rules of evidence. A man can only testify by his recollection and cannot testify to the possibility of anything existing which he cannot recollect.

Mr. Westall: The question simply goes to the certainty of the witness's memory on the point.

Mr. Blakeslee: Then it is an attempt to attack his memory, which you cannot do by the question itself, which in its very nature probes beyond his recollection.

A. Being capable of making sketches, it is quite possible that I may have made a large number that I do not now remember. As to the surety of never having done

anything which I do not remember anything about, I cannot, of course, testify definitely.

XQ. 401. By Mr. Westall: It may possibly be that my question is misunderstood. I am speaking now of the time which you have fixed as sometime in 1914, at the time of your conversation with Mr. Meyer, in which you recalled to his mind or knowledge some conversation had between yourself and Mr. Meyer concerning the disclosures which you allege to have been made in June or July, 1898, and my question is whether or not at the time of that conversation in 1914 you made or exhibited to Mr. Meyer any sketches of the device which you have testified you disclosed to him in 1898?

Mr. Blakeslee: We object to the question as repetitious and already answered, and uselessly encumbering the record with repetitious matter; and we further object to the taking up of the time of ourselves and of this witness with this mere repetitious and useless question.

A. I do not remember to have made any sketch whatever for Mr. Meyer at this time, and in this connection; and it is my belief that I did not make any such sketches. The fact that it is an engineering habit to partially converse in quickly made rough sketches rather than by the extensive use of words, precludes the possibility of an engineer stating definitely that he never did make any sketches at any time. I do not believe that I made any such sketches, and under the conditions I can see no reason which would have called for them.

XQ. 402. By Mr. Westall: Have you made any effort to ascertain from Mr. Meyer whether or not he pre-

served any of the sketches which you say you ^{may} have made in the restaurant in June, 1898, at the time of your alleged first disclosure to him?

A. No. A suggestion of that kind would have been so manifest an absurdity under the conditions, that I never even suggested it to Mr. Meyer.

XQ. 403. When you used the language in referring to your conceptions and disclosures to Mr. Meyer in the restaurant in June, 1898, "which was on that date and at that specific time that the invention disclosed in the patent here in suit was completed, so far as my conception of it is concerned," you do not mean to imply that you had in mind the exact number of electro-magnets, contacts, clutch gearings, butterfly valves and their specific connecting devices by which they are made to operate upon and with each other, they together constituting the means described in the patent in suit, or do you mean that you had clearly the idea of the result to be accomplished by the broad general features, such as by-pass and the dynamo wound as you have described, and that with these salient features in mind you believed that these specific means or instrumentalities by which these features were to be utilized would be a matter of small consequence?

Mr. Blakeslee: Objected to as indefinite, and, in so far as any purported quoted matter, may not be in accordance with the record; and furthermore, as being repetitious and calling for an answer in substance already given, the witness having testified that at the time of that conference he had not worked out all the specific details of the organization embodying the invention.

A. The state of the invention in my mind was somewhere in between the two sets of conditions which you have mentioned in your question. I had a clear and definite idea concerning the arrangement of most of the parts. I had in mind all of the elements which have been disclosed in the invention. I had not in mind the actual mechanical ^{methods} ~~means~~ by which the various parts would be made to cooperate with each other. As you have stated in your question, I did not consider this factor as important. There are so many mechanical and electro-magnetic means for producing the same identical result, that the actual design of the machine with the principles on which it is to operate to guide the designer, that the final form the machine will take is largely personal to the designer. That is to say, if the patent in suit was distributed to four able machine designers, the four machines which would be independently produced would be very different in their details, and the designs would not probably even resemble each other. At the same time, the functions which each one of these machines would perform and the manner of its performance, would be identical. So that the question of actual mechanical design of the connecting portions of the mechanism between the different fundamentally-operating parts, I had given no consideration to, and did not for some time after this disclosure to Mr. Meyer.

XQ. 404. By Mr. Westall: On your direct examination you have identified "Complainant's Exhibit A," in this case, as a copy of letters patent No. 695220, you say covers the "essential features" of a water-wheel governor which you had invented and which in-

vention you say was completed prior to July, 1898. I will ask you to explain more fully what you mean by the language "essential features."

Mr. Blakeslee: Objected to as calling for a mere repetition of testimony already given, the witness having gone extensively into the various factors and attributes and functions and elements of the invention.

A. The essential factors were a sensitive speed responsive device causing the operation of a mechanism which would operate the gates of the water wheel to open or close them in accordance with speed changes to which the speed-sensitive device would respond; means for ~~returning~~ the displaced portions of the speed-sensitive device to their normal position before the speed of the water wheel had reached its normal value; a by-pass connected to the water pipe at or near the turbine casing; a balanced, substantially frictionless valve in this by-pass, adapted to be moved by mechanism connected with the mechanism which would operate the water-wheel gate, the direction of motion being opposite to that of the main water-wheel gate, and this by-pass valve being returned from its displaced position after governing, to its normal position, the rate of motion in this latter case to be comparatively slow.

XQ. 405. By Mr. Westall: So that prior to July, 1898, you had invented a governor combining not only the essential features which you have described in the patent in suit, but also other features which you thereafter found to be unessential features and which you, for this reason, left out. Is that correct?

Mr. Blakeslee: Objected to as argumentative and placing an arbitrary construction upon the invention

which, as coming from counsel, is not the best evidence, nor evidence at all, and an attempt merely to put such arbitrary construction in words into the mouth of the witness, and as indefinite, nebulous and immaterial.

A. I do not recall that I had invented any features in connection with this governor which I afterwards considered unessential and omitted.

XQ. 406. By Mr. Westall: Then, if that is true, your statement heretofore made that you only incorporated in the disclosure of the patent in suit the "essential features" of the governor invented by you prior to July, 1898, is not strictly accurate. Is that correct?

Mr. Blakeslee: The same objection.

A. No. That statement is strictly accurate, and, after due and further consideration of the conditions I see no occasion to modify it in any particular.

XQ. 407. By Mr. Westall: Then it is true, is it not, that there were incorporated in your alleged invention prior to July, 1898, certain features which you have described as "essential features" and which were afterwards incorporated in your patent in suit, and other features which were not essential features and which, for that reason, were left out. Is that correct?

Mr. Blakeslee: The same objection.

A. The first portion of your question is a correct statement of conditions. But as to the latter portion of your question, I cannot recall that I omitted from the patent application any part or feature which I had in mind when I made the invention and which I disclosed to Mr. Meyer as before recited.

XQ. 408. By Mr. Westall: Now, you have men-

tioned Mr. E. A. Merrill, Mr. Thorburn Reid, Mr. Richard R. Bryan, Mr. Edward Lyndon, Mr. Campbell, Mr. Martin, Mr. David S. Hays, Mr. Shipley, Mr. Bailey, the patent attorney, and Knight Brothers, as recipients of certain disclosures relating to the device of the patent in suit. Will you please give the dates, or as nearly as possible approximately the dates, as you can recall, when the disclosure was made to the persons mentioned?

Mr. Blakeslee: Objected to as calling for a mere repetition of testimony, which, as the witness has and as the record shows, the witness has fixed with great care as to the times of the disclosures to the several parties designated in the record, and as a mere attempt to string out and encumber the record and harass the witness and impose upon him unnecessary labor.

A. The disclosure to E. A. Merrill was sometime prior to December, 1898, and, I believe, prior to November of that year. The disclosure to Thorburn Reid I believe to have been within two weeks after the disclosure to Henry C. Meyer, Jr., although it might have been probably the latter part of July or first part of August, 1898, before the disclosure was made to him. To Richard R. Bryan the disclosure was made at the same time; that is, within one or two days,—within one or two days' difference of time,—that it was made to Mr. Thorburn Reid. Mr. Bryan was Mr. Reid's assistant. The disclosure to Edward Lyndon was during my visit to Athens, Georgia, in 1898, and sometime during the month of July. The disclosure to Campbell was at or near the time of the disclosure to Messrs. Thorburn Reid and Richard R. Bryan. Mr. Campbell was con-

nected with the American Impulse Wheel Company, for which company Mr. Reid was acting as consulting engineer. The disclosure to Mr. Martin was sometime prior to November 1, and, I believe, prior to October 1, 1898. I am not sure about the disclosure to Hays, except that it was near the end of 1898 or the early part of 1899. The disclosure to Shipley was sometime in the early part of '99, I believe February, although it might have been earlier or later. The disclosure to Bailey was not made by me, but by the York Manufacturing Company through sketches and descriptions furnished the latter company by myself. I, therefore, do not know the date of this disclosure except that it was made during 1899, and I had every reason to believe it to have been the late spring or early summer of that year. The disclosure to Knight Brothers was made during the year 1900, and I believe it to have been in March or April of that year. The records of Knight Brothers would probably show this definitely.

XQ. 409. By Mr. Westall: Have I named in the last question all of the persons who you remember as being the recipients of disclosures concerning the patent in suit prior to your application therefor?

A. No; there are others, a few of whom I remember and some whom I do not now recall, other than those whom you have mentioned, to whom I made the disclosure of this invention.

XQ. 410. Will you please give the names of any others that you now recall?

A. I disclosed this invention to Mr. William E. Gibbs, who is a consulting engineer in New York at the

present time, and who was formerly professor of physics in the Carnegie Technical Schools at Pittsburg. Also to a Mr. Van Dyke, whose initials I do not remember, but who was connected with the American Impulse Wheel Company at the time when this matter was brought to the attention of that company. I believe also to Mr. E. M. Sutliff, at present chief engineer of the American Trading Company. About this time I had employed Mr. Sutliff, in my capacity as chief engineer of the American Trading Company, to go to Yokohama, Japan, and take up the engineering work of the Trading Company at that place, and I was with him three or four weeks continuously prior to his departure. This comprises all the additional names I can now recall.

XQ. 411. Can you state approximately the dates on which you disclosed your invention to the persons you have last named, that is to say, Mr. William E. Gibbs, Mr. Van Dyke and Mr. Sutliff?

A. The disclosure to Mr. Gibbs was made during the latter part of 1898 or the early part of 1899. I am not very clear as to the exact time except that I know it to have been considerably prior to the 1st of January, 1900. The disclosure to Mr. Van Dyke was made at approximately the same time as to Messrs. Thorburn Reid, Richard R. Bryan and Campbell, Mr. Van Dyke being associated with these gentlemen in the American Impulse Wheel Company. The disclosure to E. M. Sutliff was made either the latter part of 1898 or early part of 1899. I am inclined to believe that the disclosure to Mr. Sutliff was made sometime during the year 1898, for the reason that I left the American Trading Company in the beginning of 1900. I had made arrange-

ments to send Mr. Sutliff to Japan. He had gone there, had taken up his duties with the American Trading Company, and returned to America prior to my leaving the American Trading Company. Therefore, his return was sometime not later than the early part of 1900, and when I left the American Trading Company he was employed to take my place. In view of the fact that Mr. Sutliff was with me for some three or four weeks prior to his departure for Japan, that it took approximately twenty days to go there from New York, the same length of time to return, and that Mr. Sutliff was many months in Japan, it is obvious that collating these facts with the approximate date of his return, namely, prior to January 1, 1900, that he must have gone to Japan either in the year 1898 or very early in 1899. My present memory is that the disclosure made to him was prior to November, 1898.

XQ. 412. Are all of the persons whose names you remember as having been the recipients of disclosures or conversations relating to your alleged invention still living?

A. All with the exception of Mr. Marcellus Bailey and Mr. Richard R. Bryan.

XQ. 413. Which if any of the persons whose names you have given as recipients of disclosures concerning the alleged invention of the patent in suit, have you communicated with since the opening of negotiations with Mr. Henry, the complainant in this case, for the purchase of the patent in suit?

A. Henry C. Meyer, Jr., E. A. Merrill, Thorburn Reid, Edward Lyndon, F. A. Wunder, Thomas Shipley and Aubrey H. Martin.

XQ. 414. Did you discuss the matter fully with each of the persons you have mentioned in your last answer, of the disclosures and conversations had with them concerning the invention of the patent in suit?

Mr. Blakeslee: Objected to as not the proper method of proof and attempting to place an arbitrary construction on whatever the witness may say in response to the question, the proper method of proof being to ask the witness what he did in connection with such disclosure, if counsel is not already satisfied with the record in those respects as so far taken. And if he is not so satisfied, then we object to the question as calling for mere repetition of the testimony already given.

A. I did not discuss fully this subject with all of these gentlemen whose names have here been mentioned. I saw them at opportune times, and of each one I inquired if he had any memory of the fact that I had at one time disclosed to him a water-wheel governor, and, if so what his recollection was of such disclosure. And these different parties in many instances refreshed my memory concerning the different disclosures and how far they had understood the disclosure at the time. So that their memory of the matter seemed to be quite clear, and we of course discussed some of the previous conversations that we had. But I do not remember that in any case did we fully discuss the subject further than as I have mentioned here. In the case of one or two of the parties I did not myself see them personally at all, but communicated with them through Dr. A. S. Chessin who himself asked such of these parties as I did not see if they had any memory of the disclosure.

XQ. 415. By Mr. Westall: What efforts have you made, if any, to ascertain what became of the records of Mr. Bailey, the patent attorney, which might show the date the matter was taken up with him?

A. I have not made any efforts in this regard, for two or three reasons, the first of which is that Mr. Bailey having died, I simply came to the conclusion that it might be that his office was no longer carried on and the old records available, which conclusion might or might not have foundation. The second reason is that I have not been personally interested in this matter of searching out records, as it was not part of my obligation to Mr. Henry at the time I sold him this patent to take any such steps at all, and I therefore have not made any effort or exercised any diligence in this matter of searching for proof of date of the invention further than by communications from a few people whom I could easily reach, indicating that the date of invention was within certain limits of time.

XQ. 416. Do you know when Mr. Bailey, the patent attorney, died?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent, and not cross-examination. The present witness is not competent to testify as to the fact, and if he were it would have nothing to do with the case. The best evidence would be the mortuary records within the district within which the gentleman died, and we object to this line of cross-examination which is predicated upon the presumption that Mr. Lyndon, the witness, has been in cahoots with the complainants in carrying on this suit or preparing for the bringing of this suit, the

record showing clearly that the witness did not know against whom the suit was brought until he arrived in Los Angeles last week, and the record also clearly showing that it was no part of the transaction between Mr. Henry and the witness involving the transfer of the patent in suit that Mr. Lyndon should dig up any evidence for the complainant's use in this suit, or in any other suit other than the patent suit.

Mr. Westall: Attention of counsel is called to Rule 51 of the Rules in Equity which is intended to discourage argumentative objections of the kind which has been made, and notice is hereby given that the cost attendant upon such objections will be taxed against the complainant under the rule.

Mr. Blakeslee: We desire to have the Examiner keep this rule firmly in mind, and if he is not able to see that counsel's objection is not argumentative but rather a statement of bases of objection, he is advised to obtain counsel other than counsel for defendant to properly shape his course in the premises within the purview of Rule 51.

A. I do not know when Mr. Bailey died.

XQ. 417. By Mr. Westall: Are you sure at the present time that Mr. Bailey is dead?

A. I have no personal knowledge of his death.

Mr. Blakeslee: In view of the answer of the witness we ask that the question and answer be stricken out and withheld from consideration as frivolous and not tending in any way to establish the fact inquired about.

XQ. 418. By Mr. Westall: Is it not a fact that Mr. Bailey, the patent attorney, in Washington, in whose hands you have said the matter was first placed, did not

proceed with the application for the reason that the matter was not in shape and had not been sufficiently worked out to make an application for a patent at the time that the York Manufacturing Company were experimenting?

Mr. Blakeslee: Objected to as indefinite, calling for a conclusion of the witness, not the proper method of proof, not calling for the best evidence.

A. What Mr. Bailey's own views of the situation were, I, of course, have no means of knowing, as I did not personally ever come in contact with him until I went to Washington in the early part of 1900 to get such papers, sketches and drawings, as he had, in order to carry them to Knight Brothers. The sketches furnished by me to the York Manufacturing Company were amply sufficient for Mr. Bailey's use to draw a patent specification and claims from. Whether the York Manufacturing Company decided that they preferred to manufacture one or two machines and experiment with them prior to taking out the patent, or whether the documents were delayed in transit from the office of the York Manufacturing Company to Mr. Bailey, or whether they were sent promptly to Mr. Bailey and the work of preparing patent application was deferred owing to the press of other business, and the apparent feeling that there was no need of hurry, I can not say. I have been informed that the last state of affairs was the one which actually existed.

XQ. 419. By Mr. Westall: Have you any personal knowledge as to whether or not the fees were paid to Mr. Bailey for any services to be performed in making

application for patent on the device of your alleged invention?

A. No.

XQ. 420. When you went to Mr. Bailey to get the papers from him after the York Manufacturing Company had definitely declined to go on with the work, did you have any conversation with Mr. Bailey concerning the question of whether or not his fees or any part of his fees had been paid?

Mr. Blakeslee: Objected to as placing an arbitrary determination on the testimony of the witness respecting the nature of the terms of the tentative agreement between the witness and the York Manufacturing Company, and as irrelevant, immaterial and not the proper method of proof, not calling for the best evidence on the subject.

A. No. That was strictly a matter between Mr. Bailey and the York Manufacturing Company. I understood that Mr. Bailey was the patent attorney for the York Manufacturing Company, acting on all matters of that character for this company, and that the preparation of patent applications for the water-wheel governor covered by such patent in suit would simply have been a portion of the work which he was continually doing for that company. Whether this statement will have any bearing on the question of fee, I do not know. But the York Manufacturing Company at that time had a capitalization of a million and a half dollars.

XQ. 421. By Mr. Westall: Did you see Mr. Bailey personally at the time you severed your relations with him?

A. I am not sure that I saw Mr. Bailey personally, or one of his assistants. I am inclined to think that it was one of his assistants whom I saw who got up the sketches and written descriptions and delivered them to me. I cannot be sure about this, but that is my impression.

XQ. 422. Had any specification or first draft of the specification been made at the time you got the papers from Mr. Bailey?

A. That I do not remember.

XQ. 423. Can you state just when it was that you got these papers from Mr. Bailey or his assistant?

A. It was between the middle of February, 1900, and the 1st of April, 1900. I can fix this time with fair accuracy, because it was in February, 1900, that I went to Baltimore on some special work which kept me there until October of that same year, and within a very short time after I went to Baltimore on this work I went to Washington and obtained these documents from the office of Mr. Bailey. To the best of my recollection, this occurred sometime in March, 1900.

XQ. 424. Do you remember just what papers you got from Mr. Bailey or his assistant at that time?

A. No, I do not. I only remember that there were a considerable number of papers. Some were my own original sketches; some, if I remember correctly, were suggestions or notations on the margin of either Mr. Bailey or some person in his office, and I am not sure but that one patent drawing had been made. In fact, I now recall that the drawing which formed Sheet 1 of the patent in suit was made up to be used in the preparation of the patent application, and it is obvious from this

drawing that it was made up from rough sketches. So that the work of preparation of the patent had proceeded as far as the making of this drawing. Further than that I have no memory as to the number or character of documents which I obtained from Mr. Bailey's office.

XQ. 425. Could you state approximately how many drawings there were?

A. I have not the remotest idea. My own habit of making rough sketches and then explaining these original sketches by other rough sketches of a more detailed character would lead me to believe that there were a considerable number of such sketches. But I cannot now say that that was the actual truth.

XQ. 426. Do you remember distinctly the drawing which you believe to have been a patent application drawing and which you found among those papers?

A. I do not remember this drawing specifically as one of the drawings that I obtained from Mr. Bailey's office, except inferentially. I know that the drawing was made for a patent application, and in behalf of the York Manufacturing Company. I know that it was subsequently used in my patent application which eventuated in patent No. 695220, and without remembering this to be the fact, I am perfectly assured that I carried this drawing to the Knight Brothers and that I never personally prepared it. Therefore, as I say, my memory of having obtained this drawing from Mr. Bailey's office among the others is not intrinsically true and is only inferentially true.

XQ. 427. How soon after you got these papers from Mr. Bailey or his assistant, sometime between Feb-

ruary and April, 1900, did you take up the matter of your patent application with Knight Brothers.

A. I cannot say; but I know that it was as soon thereafter as I was able to leave Baltimore and go to New York.

XQ. 428. Was it a month after, or two months?

A. It must have been very soon; certainly not over two weeks after I obtained the papers from Mr. Bailey, if my present memory is correct, because I obtained them for the purpose of having a patent application prepared and filed, and I know that I did not defer this any longer than necessary for me to take an opportune time to go to New York. And during the period of my stay in Baltimore I used to go to New York at intervals of from two to three weeks. From this I would state the period of turning the matter over to Knight Brothers, as within three weeks after I obtained the papers from Mr Bailey's office.

XQ. 429. So that you would feel very confident in saying that it could not have been later than the 15th of April, 1900, when you took this matter up with Knight Brothers?

A. I could hardly be that specific, but, as I have before stated, my memory of the time that I went to Mr. Bailey's was in the early part of the year 1900. As far as this memory is correct, just so far would be correct the statement which I now make, and that is that I believe the subject matter of this patent to have been in the hands of Knight Brothers by the middle of May, anyway, 1900, and possibly earlier.

XQ. 430. At the time that you took the matter up

of the application of the patent in suit with Knight Brothers, did you pay any money to Knight Brothers?

A. That I do not remember. I, however, think it unlikely.

XQ. 431. Did you make any arrangement for the paying of their fees at that time?

A. I do not remember; I do not think that I made any bargain with them. My memory is that I simply turned the papers over to them and requested them to prepare and file a patent application, and, knowing Knight Brothers and certain circumstances connected with other patents which they have taken out for me, it is my belief that they called on me at the time of applying for the patent simply for the government fees, and that when the patent was finally ready to issue they then asked me for the final government fees, and then later sent a bill for their services. I believe this to have been the course of the transaction, though I cannot state with any degree of positiveness.

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XQ. 432. Had Knight Brothers previously taken out patents for you, before you placed in their hands the application for the patent in suit?

A. No; this was the first one they ever took out for me.

XQ. 433. Did you ask them at that time what their fees would be?

Mr. Blakeslee: Objected to as having been already gone into, and being repetitious.

A. No; I did not.

XQ. 434. By Mr. Westall: So that you simply

left the papers in their hands, without any definite arrangement or contract of any kind?

Mr. Blakeslee: Objected to as not the proper way of taking proofs. Let the witness be asked what he did, if counsel is not already satisfied, and not to attempt to put words in his mouth or testify for him.

A. Yes.

XQ. 435. By Mr. Westall: You have stated that you do not remember exactly when it was that you took up the matter of getting up working drawings for the device of the patent in suit with the York Manufacturing Company, but that it was early in 1899. How soon after that was it that the York Manufacturing Company took the matter up with Mr. Bailey, the patent solicitor at Washington?

A. That I do not know. I was never apprised by the York Manufacturing Company of this date, and I only know that after the lapse of several months—just how many I haven't now any clear idea—that I called the attention of the York Manufacturing Company to the failure of their attorney to prepare a patent specification and drawings, or to their failure to send me such patent specification and drawings for inspection if such had been prepared.

XQ. 436. How soon after you placed the matter in the hands of Knight Brothers and requested them to make application for a patent was it that any specification or drawings for such patent application were prepared by them?

A. That I do not know. I think it was subsequent to May, 1900.

XQ. 437. Was there then a considerable delay be-

tween the time you placed the matter in their hands and the time at which they prepared this patent application and drawing?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts, and not the proper method of proof.

A. There might have been. I do not remember now.

XQ. 438. By Mr. Westall: You were not then following up the matter very earnestly or with very much interest, were you?

Mr. Blakeslee: The same objection.

A. I, of course, had a considerable interest as to following up the matter. I scarcely understand what I could have done or failed to do that would be indicative of this. I had turned over the information in such form as I considered to be complete and which, apparently, the office of Knight Brothers fully understood; and I further had a realization that they were patent lawyers of international reputation, and had many other things to do besides the preparation of my one patent application. I felt sure from my knowledge of them and their standing that it would be properly and reasonably attended to; and if by not following it up you mean that I did not at frequent intervals call at their office and demand haste, I did not.

XQ. 439. By Mr. Westall: How many times after you first left the matter of the application for the patent in suit in the hands of Knight Brothers did you call upon them or communicate with them relative to the progress of your application?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent.

A. The impossibility of stating anything which might be even relatively correct fifteen years subsequent to the period you refer to, when I have no other circumstances whatever to connect visits to the office of Knight Brothers with, and further, that I was then staying in Baltimore and went to New York only when called there by the people I represented, and that sometimes I would have only one day in New York and would be unable to see any but my principals, and at other times I would have available a day or a few hours before returning to Baltimore, is obvious, I believe. I cannot even remotely conjecture.

XQ. 440. By Mr. Westall: Do you believe that you ever called upon Knight Brothers between the time that you placed the matter of the application for the patent in suit in their hands and the time that the application was sent to the Patent Office, with reference to the progress of the application?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, not the proper method of proof. What the witness believes is not evidence nor a statement of facts.

A. I know I called on Knight Brothers several times during this interval. It is probable, I should say, in fact, inevitable, that I at times discussed the matter of my patent application with them. In order that you may more fully understand, however, that I may have often called at Knight Brothers' office without having entered into the matter of this or any other patent application, it is well to here inform you that the several members of the firm of Knight Brothers were and are all my personal friends, and I have made many calls at

the office of Knight Brothers without having any business to conduct or discuss with them, and entirely for social and friendly purposes.

XQ. 441. By Mr. Westall: Do you know who drew up the specification of the patent in suit?

A. In my discussion with Knight Brothers of this matter, the whole matter seemed to be in the hands of Mr. Percy Knight, although Mr. Harry E. Knight went over the matter at one time. It is my impression that the actual preparation of the application was done by Mr. Percy Knight; but of this, of course, I can not be sure.

XQ. 442. Did you read over the patent specification before it was sent to the Patent Office?

A. I do not remember, but it is my belief that I did, simply based on the fact that it is my custom to read over patent specifications and claims in any patents which I have either taken out myself or which have been taken out by corporations to which I have acted as technical adviser, prior to their finally being sent to the Patent Office.

XQ. 443. You do not recall, do you, that the person who drew the patent specification had any trouble in understanding the device and its method of operation, and came to you for further explanations than those contained in the sketches that you turned over to Knight Brothers?

Mr. Blakeslee: Objected to as assuming a state of facts contrary to those testified by the witness, namely, that the attorneys Knight Brothers relied alone on the sketches and papers brought them by the witness, pre-

paratory to drawing up the specification, claims and drawings of the patent in suit, and, therefore, tending to mislead the witness, and contrary to his testimony.

A. I do not remember that Mr. Percy Knight ever experienced any difficulty in understanding from the sketches and descriptions which I gave him all of the features which later were incorporated in the patent No. 695220. It is my belief that such failure to understand never occurred, both by reason of the fact that the subject matter was in a very complete form, and that Mr. Knight, so far as my judgment goes, has a trained scientific and engineering mind of quick perception.

XQ. 444. By Mr. Westall: So that while your recollection is not quite entirely clear, you believe it may have been possible that that description contained in the patent specification may have been sent to the Patent Office without your having previously read and checked it over to find out whether or not it was correct?

Mr. Blakeslee: Objected to as simply suppositious and argumentative and calling for a matter purely of belief and not for a statement of facts, but rather for the guess of the witness which cannot be evidence in these particulars.

A. Of course, where I do not definitely remember what did or did not occur, any occurrence or want of it which may suggest itself to you might have transpired. It is possible that I did not read the specifications and it is probable that I did, but as to what actually happened I have no present recollection.

XQ. 445. By Mr. Westall: The matter of your application at that time was one of great importance to

you, was it not, and one in which you were deeply interested, at the time, was it not?

A. I considered it to be of considerable importance and I was deeply interested in it.

XQ. 446. Now, after this application was sent to the Patent Office, have you any recollection of any time thereafter, before the grant of the patent, of carefully reading the application and comparing it with the drawings of your patent application?

A. No. I thought I had fully testified on this subject by the statement that I did not remember ever having read the specification, and believed that I had read them only because it has always been my habit to do this. I remember nothing about it. I do not know whether I ever saw them before they went to the Patent Office, and I don't know whether I even ever saw any of the references that might have been cited by the Patent Office in answer to some of the claims, and I am totally without recollection as to whether I did see these specifications and drawings or whether I did not.

Mr. Blakeslee: We object to this whole line of cross-examination on the ground that the best evidence and the particulars inquired about is the record in this case, and the file wrapper and contents of the patent in suit, showing the several parts of the application as filed, including the oath of the applicant, the present witness, as to the invention, and all parts thereof disclosed in and claimed by the application for the patent in suit, such file wrapper and contents including such oath being in evidence under certification of the Acting Commissioner of Patents and being "Complainant's Exhibit B." This

is the best evidence in these particulars, as it is the record of the Patent Office in these particulars. The application is on file and it shows that the prosecution of the application was in the hands of Knight Brothers, attorneys for the witness.

XQ. 447. By Mr. Westall: Now, the file wrapper and contents referred to by counsel in his previous argumentative objection is what appears to have been subscribed and sworn to by you on the 8th of September, 1900. In that oath you have sworn that you believed yourself at that time the sole inventor of the improvements described in the specification which accompanied the oath. Do you mean to say that it is possible you made this oath without having read the specification in order to ascertain whether or not it correctly described the invention which you were endeavoring to patent?

Mr. Blakeslee: Objected to as frivolous and irrelevant and immaterial, not the proper method of proof, not calling for a statement of facts, but being the mere hazard or guess of the witness as to the possibility, and is not tending in any way to prove any of the issues in controversy in this suit, that it is mere record-stuffing and encumbering procedure which is in line with the greater part of the cross-examination of this witness so far developed.

A. I do not mean to make any such statement and am now unable to remember any statement of any kind that I have made that would lead to any such inference.

XQ. 448. By Mr. Westall: Would not the fact that you made such an oath, attached to your original application, conclusively satisfy you that you had read and

examined the specification accompanying that oath in order to understand fully what was contained therein and in order to know that you were not swearing to something which was not true?

Mr. Blakeslee: Objected to on the same ground, that it is a mere self-serving statement and an attempt of counsel to testify without being sworn, and calling for the mere hazard, guess or psychological conclusion, not being the proper method of proof, if there be anything to prove in and about the indefinite subject of the question, and that it merely encumbers the record.

A. As I have previously testified, I am fully satisfied from a knowledge of my usual acts in connection with patent cases that I did read this patent application. I have also testified that I do not have any distinct memory of having done so, when it was done, under what circumstances, or in the company of whom, or at what hour of the day. Further than this I am unable to state concerning the matter of having read the application.

XQ. 449. By Mr. Westall: Were you informed of the first action of the Patent Commissioner before any argument or reply was made by your attorneys to it, and did you advise with your attorneys or consult with them concerning the objections made by the Examiner and communicated by him in the letter of October 29, 1900, which is made part of the file wrapper and contents of the patent in suit in evidence?

A. I do not remember that this Office action ever came before me, nor do I remember any other Office action having been referred to me by Knight Brothers. I cannot state that this or other actions were not mention-

ed to me or brought to my attention, but, if they were, I have no present memory of the fact.

XQ. 450. You have testified that according to your recollection you placed the matter of your patent application for the patent in suit in the hands of Knight Brothers prior to May, 1900. Have you any explanation to offer for the long delay, namely, of from April to the 1st of May, until September, in the taking of any action by Knight Brothers upon your application?

Mr. Blakeslee: Objected to as it assumes the testimony of the witness to be that no action was taken by Knight Brothers during the period of time mentioned, and as merely repetitious, the witness having testified fully as far as his knowledge is concerned with respect to his contact with Knight Brothers during that period in connection with any urging of procedure by them.

A. I am unable to offer any explanation which, it seems to me, would properly come from Knight Brothers. My experience in applying for patents and the experience of corporations which I have at times been connected with in applying for patents, has been such as to cause me to consider that the lapse of such a period of time between the opening up of the subject with the patent attorneys and their preparation of the patent papers, is only a usual and normal period for the accomplishment of this work; and the lapse of this length of time would not induce the opinion that there had been any negligence on the part of the patent attorneys. My experience is, of course, limited to some of the more prominent offices in New York where most of the practice is in patent law, and in which, therefore,

patent applications must receive such attention as can best be given under these conditions.

XQ. 451. By Mr. Westall: Why was it if you read, as you testify you believe you must have read, the original specifications sworn to by you as appears from the file wrapper of the patent in suit in evidence, that you did not notice the important omission in the patent specification and drawings to indicate that any adjustment might be made which would permit the by-pass valve to be normally closed?

Mr. Blakeslee: Objected to as assuming something contrary to the testimony of the witness, namely, that there was any omission in this respect. The testimony of the witness clearly shows that provision was made for adjusting the by-pass so that it could be closed, by means of turnbuckles, shown in the drawings. It is objected to as placing an arbitrary interpretation upon the patent in that respect, contrary to the facts supported by the disclosure of the patent, and, therefore, is misleading. Furthermore, it is objected to as argumentative and as being answered by the previous testimony of the witness as far as it may be answered in its argumentative form, and as attempting to lead the court into a misinterpretation of the invention and a misconstruction of the disclosure thereof in the patent.

A. I never observed at the time, nor has it come to my knowledge since, that that omission was made.

XQ. 452. By Mr. Westall: Please explain why, if an adjustment which would permit the by-pass valve to be normally closed was such an important feature of your invention and was so necessary under certain con-

ditions of good governing, as you have testified, that you did not make some reference in the specification of the patent in suit to the turnbuckles described by you as adjusting means (and which are shown in Fig. 5 of the drawings of the patent in suit), or why they were not later described, or their purpose and function fully described?

Mr. Blakeslee: Objected to upon each of the grounds last made of record, particularly as being argumentative, and an attempt to place an arbitrary and false construction upon the disclosure of the patent, and as improper procedure in each of the respects in this objection named, as not the proper method of taking proof and not tending to establish properly anything pertinent to the issues in controversy, and as distorting the testimony of the witness previously given.

A. The preparation of these patent specifications and drawings was entrusted to the Knight Brothers who, I believed, and still believe, to be capable of guiding inventors, preparing specifications, claims and drawings for this purpose, and it was to their special and expert knowledge which I did not have that I trusted. To my mind the fact that a turnbuckle is specifically an adjustable member and known in the mechanical art as such, and useful for no other purpose, seemed to my mind, which might be termed simply a mechanical mind, to cover the necessity. In other words, I thought the depicting of these turnbuckles sufficiently covered the ground by the obviousness of their use. I would as soon have thought of making the statement in the patent specification that the rope to which the turnbuckles were

attached and which were to move the by-pass valve would have to be strong enough to perform this function and not so weak as to break in attempting it. Also, it would have appeared to me as rational to make the statement that the butterfly valve had to be tight on the shaft, which was moved by these ropes, and that it would not operate if loose on the shaft, as to have made any statement about the object of the turnbuckles. Whether my view is proper as to your point of patent law, is for lawyers and courts to determine. To my mind the entire matter was covered.

XQ. 453. By Mr. Westall: It is a fact, is it not, that the turnbuckles illustrated in Fig. 5 of the drawings of the patent in suit would have a useful purpose to subserve in taking up the slack of the ropes "51", "52" and permitting the by-pass valve to be properly centered even in a plant where it was desired to have the by-pass valve normally half open and where it was not desirable for any reason to economize water?

A. That is unquestionably true. They would be a convenient means of adjusting the valve to its middle position, as you have stated.

XQ. 454. So that it does not conclusively follow that because you have shown turnbuckles in Fig. 5 which might allow a certain limited adjustment of the by-pass valve or which might allow the taking up of a slack in the rope, that these devices would indicate to a skilled mechanical mind or to one skilled in the art that it was your intention that this by-pass valve should be adjusted so as to be under certain conditions normally closed?

Mr. Blakeslee: Objected to as not the proper method of proof, and as merely argumentative and attempting to put words in the mouth of the witness, and as not calling for a statement of facts, and tending to place an arbitrary construction upon the disclosure of the patent and the various adaptations of that disclosure to the various conditions of service and use.

A. It would disclose to anyone fully skilled in the art who has an understanding of not only the mechanical and electrical devices, but the conditions under which water wheels operate, and the variable conditions of water supply from usual streams and rivers, that the by-pass valve would at times take a closed position. The general condition, and the preferable condition, to my mind the most desirable condition, is to have the by-pass valve half open and half closed, and an ample supply of water to take care of the power requirements and enough to waste for good governing. This is a general statement of preferable practical ideal conditions. That these are not always present is true of most water powers, and, therefore, the next best thing is the maintenance of a by-pass valve closed and merely operated in a direction to open.

XQ. 455. By Mr Westall: It is true, is it not, that in the specification of the patent no hint or suggestion is contained that these turnbuckles might be so adjusted as to permit the by-pass valve to be normally closed?

Mr. Blakeslee: Objected to as not proper method of proof and not calling for the best evidence, the best evidence being the disclosure of the patent in suit itself, and as therefore attempting to place an arbitrary inter-

pretation upon the disclosure of the patent in suit and put the same in the mouth of the witness.

A. I have not carefully read the specification of the patent in suit for many years, and I do not remember whether there is any hint of the full purpose of the turnbuckle or not. I do not remember that any statement is made either in the specifications or the claims that by the use of these turnbuckles the valve can be changed from an adjustment in its semi-open condition to an adjustment in which it is closed or to an adjustment in which the closed position becomes its normal one.

XQ. 456. By Mr. Westall: Now, it is true, is it not, that if constructed according to the scale of the drawing (Fig. 5) of the patent in suit, neither of these turnbuckles have a sufficient range of movement to permit any more than a very slight adjustment, no more than would be reasonably necessary to take up any slack in the ropes "51" and "52" or to adjust the position of the by-pass valve, and certainly not sufficient to permit the rotation of the valve stem a sufficient distance so that the normal position of the by-pass valve may be normally closed?

Mr. Blakeslee: The same objection, and that it is calling for a conclusion on the part of the witness and as going into questions of interpretation of the patent disclosure concerning degree, and in this respect it is particularly objected to inasmuch as neither the statutes nor the rules of practice of the Patent Office require patent disclosures of mechanical construction to contemplate matters of degree to the refinement of scale calculation. It is therefore merely argumentative, without

foundation either in fact or law, and particularly in fact, as based upon the testimony of this witness or any other witness in this case; and in this latter respect, particularly, not proper cross-examination and not cross-examination in any respect in rebuttal.

A. If this Fig. 5 be taken as a specific mechanical design and the parts built to a scale relative to that of the drawing, the amount of change in length of the two ropes possible through the action of these turnbuckles would be very small, and certainly insufficient to change the adjustment of the gate opening from that of half-open at normal position to that of being fully closed at normal position.

XQ. 457. By Mr. Westall: It is also true, is it not, that such so-called adjusting means are omitted from Fig. 1 of the drawings of the patent in suit, and that no similar, or any kind, of adjusting means are there disclosed?

Mr. Blakeslee: The same objection, and particularly that the question calls for evidence which is not the best evidence, the best evidence being the disclosure of the patent, and, therefore, the question being merely a self-serving statement, and argumentative, if anything else.

A. There is no similar means of adjustment of the relative lengths of the two ropes, but the ends of the ropes are indicated as carried through holes in the ends of the lever, brought out and tied up alongside the main length of the ropes, which would indicate that whatever adjustment was intended to be made in the gate would be made at these points.

XQ. 458. By Mr. Westall: It is true, is it not, that

a much greater range of movement of the turnbuckles would be necessary if it was desirable to adjust the by-pass valve to occupy a closed position than if those turnbuckles were merely used to take up the slack in the rope or allow the by-pass valve to be slightly adjusted in its normal half-open position?

Mr. Blakeslee: The same objection as made in the last three instances of objection.

A. In practice the turnbuckles would have to be a little, but very little, longer for the purpose of adjusting the position of the valve from half-open to fully closed, than they would have to be when they merely served the purpose of adjusting the valve in its partly open condition. The reason for this lies in the fact that the distance of the by-pass valve from the water-wheel governor in practice would be relatively considerable, and by no means would the parts be relatively adjacent, as indicated in the patent drawing. In the construction of plants, the turbines and their penstocks are frequently located outside of a building, the ends of the turbine projecting into the building; and in the later types of plants the turbines are below the floor of the building and sometimes 20 or 30 feet or even more below the operating floor. Any rope connection from the governor to the by-pass valve, which latter valve should be located as near to the water-wheel inlet as possible, would in such cases take a devious path, passing over guide pulleys, and, while it would be possible, it would not be commercially practicable to pull up these links of rope with a short turnbuckle, if a turnbuckle were used for the purpose; and the difference, therefore, in the length

of the turnbuckle required for such purpose, and for adjusting the valve, would not be very considerable. There would, however, as you have indicated, be some difference.

XQ. 459. By Mr. Westall: But even in a plant where water economy was not an object, such turnbuckles as illustrated in Fig. 5 of the drawings of the patent in suit would be a highly desirable if not necessary means for making any slight adjustment of the by-pass valve or taking up the slack of the ropes "51" or "52", would it not?

Mr. Blakeslee: The same objection as last indicated.

A. I believe that turnbuckles might be helpful in such cases, or certain similar means of adjustment would be required.

XQ. 460. By Mr. Westall: Laying aside the question of the sufficiency of the range of movement of the turnbuckles shown in Fig. 5 of the drawings of the patent in suit to permit an adjustment which would allow the by-pass valve to be normally closed, and reading into the patent, for the purpose of this hypothetical question, "turnbuckles with a sufficient range of movement to permit the closure of the by-pass valve under normal conditions," suppose that such turnbuckles were operated so that the by-pass valve would be kept in a closed position under normal conditions of speed and load, I will ask you to describe the operation of the device of the patent in suit when the load is increased.

Mr. Blakeslee: The same objection, and that it is indefinite.

A. On increase in load the entire mechanism would

be set in motion by the change in the position of the parts of the speed controlling device as has before been described, and motion of the gate shaft would take place to open the gate valve. The clutch "57", "58" under the conditions of the by-pass being set normally partly open and partly closed, would rotate in such a direction as to cause the valve to close. The by-pass valve now being fully closed, motion in this direction can not take place at all, or, certainly over simply an infinitesimal distance. Pin "73" shown as being attached to the sheave wheel "54" cooperates with the contact-making parts "74", "75". This pin when properly adjusted will immediately open contact "74", "75", thereby opening the circuit through magnet "64" and preventing that magnet from being energized. This, as is obvious from the relation of the parts in the patent drawing, prevents operation of the clutch when motion takes place in this direction. Therefore the gate shaft continues to turn, increasing the opening of the water-wheel gates, but the by-pass valve, having reached its limit of motion, does not move.

XQ. 461. By Mr. Westall: What would prevent the by-pass valve from continuing to move, it being remembered that we are assuming now that the by-pass valve is closed and an increase of load requires the opening of the main water gate to a greater extent?

A. There would initially be a tendency to move the by-pass valve in the direction of closure—

XQ. 462. (Interrupting) That would mean that the by-pass valve, being already closed, would have a

tendency to move past closure and open the other way, would it not?

Mr. Blakeslee: Objected to on the same ground, and that it is assuming conditions apparently impossible and that it is putting an arbitrary interpretation upon the patent.

A. It would have a tendency to rotate just as you point out; but in the standard and well-known construction of the butterfly valve, rotation past closed position without fracture of the parts would be impossible.

XQ. 463. By Mr. Westall: Is it your understanding that the butterfly valve shown in the drawing of the patent in suit is of the same general construction as the damper in a stovepipe, for instance?

A. In a measure it is.

XQ. 464. And a damper in a stovepipe can be rotated entirely around its axis, ordinarily, can it not?

A. I believe that is usually the case.

XQ. 465. And it is true of this butterfly valve, as illustrated in the drawings of the patent in suit, that it may be likewise rotated beyond a closed position in either direction or in both directions, is it not?

A. No; the butterfly valve shown in the patent in suit is made up of a rotating plate in a cylindrical pipe. The plate itself is not circular, but is elliptical in form, which means that after having rotated towards its closed position and after having come to a fully closed position, it still does not have the plane of the plate perpendicular to the axis of the pipe, but stands at a small angle with it. The standard butterfly valves for hydraulic use usually are provided with flanges on the in-

terior of the pipe, against which the elliptical plate comes to rest when fully closed. In any case, they cannot be rotated past the point of full closure.

XQ. 466. There is, however, not shown in any of the drawings of the patent in suit any means for preventing this butterfly valve to be rotated past a closed position, unless it possibly be the dotted lines indicated by "48" which might possibly be construed slightly elliptical. Is that correct?

A. That is true.

XQ. 467. Now, in "Complainant's Exhibit C," the by-pass valve "48" is not shown elliptical in form, nor is there anything to indicate that any stops are provided to prevent such valve from rotating beyond the closed position. Is that correct?

Mr. Blakeslee: Objected to as merely argumentative and attempting to place a construction upon the showing by implication rather than by the educing of testimony, having no foundation in the record to support it as a proper question in rebuttal.

A. I would say that the drawing, although it may not be clear at the first glance, would indicate the plate to be elliptical.

XQ. 468. By Mr. Westall: You do not find in "Complainant's Exhibit C," to which you have been referred in the last question, any means of adjusting the length of the ropes "51", "52" to permit the by-pass valve to be normally closed, do you?

Mr. Blakeslee: Objected to as irrelevant, immaterial and incompetent, and not proper rebuttal examination,

and merely argumentative and not calling for the best evidence.

A. There is no means shown for this adjustment, except that the drum "54" may be rotated freely on the shaft till any adjustment of the valve is reached, and on release in its new position will be successfully ~~clutch-~~^{valve}ed and unclutched by the electrical sliding clutch "57", "58". Other than this there are no adjusting means.

XQ. 469. By Mr. Westall: Such a rotation of this drum, if it were made, would require a re-adjustment of the pin "73" and would also require a new adjustment of the shaft with relation to the worm "18", would it not?

A. It might require a new adjustment of pin "73", but there would be no change in the relation between the parts of the worm gear "18".

XQ. 470. If the by-pass valve is placed in a position to be normally closed, and if then an increase of load is placed upon the wheel requiring the opening of the main gate, this would, as you have described, be followed by a tendency of the by-pass valve "48" to move past its closed position, and this tendency would be resisted merely by the pressure or friction of the by-pass valve on the side of the pipe. Is that true?

A. Not completely. It is all true with the exception of the use of the word "friction", as the resistance to the motion of the by-pass valve. The disc of the by-pass valve having one of its dimensions greater than the diameter of the pipe, comes in actual pressure contact with the side of the pipe, and the resistance which may be set up to the further motion of this plate is only limit-

ed by the strength of the materials of which the valve is composed, and could in no wise be considered as a frictional resistance. Otherwise, however, your statement that the further motion of the by-pass valve disc is resisted, is correct.

XQ. 471. In case of suddenly throwing on of a great and severe load when this by-pass valve is placed in normally closed position, this tendency of the by-pass valve to move and this resistance to the movement would be likely to result in the breakage of some of the parts of the apparatus, would it not?

A. Not if they were properly designed. For instance, if the proper strength of by-pass valve and operating ropes were provided, the electrical operating clutch "57", "58" could slip continuously around without injury to any of these parts. Of course, if there were considerable movement of the shaft "20" with the clutch engaged and the gate resisting motion, and this were prolonged over any considerable period of time, say of an order of several months, the wear on the clutch faces would be considerable. In fact, it might be so great that the clutch faces themselves would require to be replaced. But under the conditions of the circuit to magnet "64" being opened, after rotation has proceeded through comparatively a short distance,—say 8 to 12 degrees of angular distance—this wear on the faces of the friction clutch is practically nullified.

XQ. 472. Now, you find no hint or suggestion in the patent at any place that these parts should be made strong enough so that in case it were desirable to have a valve in normally closed position that they would re-

sist any such unusual strain that might be imposed upon them, do you?

Mr. Blakeslee: Objected to as calling for an arbitrary interpretation of the patent in suit, and not calling for the best evidence, the disclosure of the patent itself being the best evidence, and that the question is merely argumentative.

A. I would consider the hint that these parts should be of that character as definite as I do the inference that the journals of a machine should be made of proper length and diameter, and provided for being oiled, although there is no statement to this latter effect. The reason why any machine designer would so design the apparatus to have ample strength to resist any such forces, is that under any condition, even if the by-pass gate be kept partly open and partly closed, it does under the action of governing move to a condition of being fully closed. If at the moment of reaching this fully closed position the circuit through magnet "64" were not opened, the stresses which have just been discussed would be set up. It would be appreciated by any competent machine designer that it would be difficult to so adjust the arrangements for the opening of the circuit through magnet "64" to exactly coincide with the point of closure; and even if it were possible, it is very probable that a careless erector of an apparatus would not so adjust it. This would mean that when the by-pass valve would reach its fully closed position, any further rotation of the shaft over that course, without the circuit through the magnet "64" being open, would cause rupture of the parts if they were not sufficiently strong to resist the forces which could be set up. So that in

any case and under any interpretation, the strength of these parts sufficient to resist the pull produced by the sliding clutch and be able to withstand this tendency to rotate even up to complete slippage of the clutch, would be obviously necessary.

XQ. 473. By Mr. Westall: It is true, is it not, that at the only place in the patent drawings where the by-pass valve is shown, its stem "49" is shown, according to the scale of the patent drawings, to be very weak and not at all sufficient to stand any such strain or stress as would be necessary if said valve were placed in normally closed position and an increase of load was placed on the wheel?

Mr. Blakeslee: Objected to as attempting to place an arbitrary construction upon the disclosure of the patent in suit, not calling for the best evidence, the best evidence being the disclosure of the patent itself, and also that it is merely argumentative.

A. If the same scale be preserved and related to the other parts, namely, the number of turns on the magnet, the air gap, the lever arm through which the magnet works, and the size of the clutch operated by it, this stem "49" would be amply large to resist any forces which might be set up by these parts.

XQ. 474. By Mr. Westall: If the by-pass valve is placed in such a position as to be closed under normal conditions of speed and load, in case of an increase of load the device of the patent in suit would not accomplish completely the express objects therein, would it, namely, the overcoming of inertia effects caused by both opening and closing of the main water gates?

Mr. Blakeslee: The same objection as last noted.

A. Under this condition the by-pass valve would in no wise affect the change in the velocity of the column of water in the pipe for a specific movement of the gates from one position to a more open position.

XQ. 475. By Mr. Westall: So that the expression just put as contained in the specifications would be only partially fulfilled by such an adjustment. Is that correct?

Mr. Blakeslee: The same objection, and we insist that this line of examination is manifestly improper, inasmuch as it attempts not to compare structures or functions, but merely to assume the function of a court in interpreting the patent, and attempts to force upon the court hide-bound modes of interpretation and limits of interpretation instead of tending to illustrate the matters in controversy, and this objection and those last made will be understood as repeated to all this line of purported cross-examination without the necessity of specific repetition.

A. The device would be able and prepared to fulfill every condition set forth in the description and specification of the patent in suit. The fact that one portion of the device in operation had reached its limiting position and would go no further, does not to my mind indicate that the conditions and characteristics of the invention would not be fulfilled. The same condition which you mention would occur even when the gate is set in a partially open position as its normal one, if a very great motion of the water-wheel gates is required. Because in the first movement in governing, the distance of the

travel of the different parts of the machine might be such as to close the by-pass while opening the water-wheel gates, during which portion of the operation the conditions would be as outlined. It might be, however, that the governor mechanism would move still further, still opening the water-wheel gates; but the by-pass valve having reached the limits of its travel, could not open any further. In this latter portion of such an action, the conditions would be the same as when the by-pass valve is set in a normally closed position. To my mind the fact that the by-pass valve may be set in a position which is normally closed, so that opening of the water-wheel gates is not accompanied by a further closing of the by-pass valve, even though closing of the water-wheel gates will be accompanied by an opening of the by-pass valve, does not indicate that the functions of the invention are not fulfilled.

XQ. 476. By Mr. Westall: But whether or not the by-pass valve would open wide enough to overcome inertia effects of the water, or would close sufficiently for the same purpose, when the main water gate was either open or closed, would depend entirely upon the design of the particular plant and, particularly, upon the size of the by-pass "47". In other words, if this by-pass was made of sufficient size, as large as the penstock, if you please, it would be possible to take care of all inertia effects, regardless of the extreme nature of the load, would it not?

Mr. Blakeslee: Objected to as fragmentary and not complete, as argumentative, and as a mere arbitrary statement put in question form, and not the proper method of proof.

A. I am sure that it would.

XQ. 477. By Mr. Westall: One of the objects expressed in the specification of the patent in suit is that of overcoming certain opposite effects, namely, the inertia effect of water which would follow the opening of the water gate, and another effect being the inertia effect which might follow the closing of the water gate. It is a fact, is it not, that if this by-pass valve is placed in normally closed position, it does not completely accomplish these objects in that it does not overcome the effect of further opening the main gate upon an increase in load?

Mr. Blakeslee: We do not know in what manner from the record of the patent the by-pass valve opens the main gate, and furthermore, we assume that counsel will sometime terminate standing as expounder of the patent in suit and testifying about it, and will leave to the witness the giving of the testimony. We object to the question again strenuously as being argumentative and attempting to place an arbitrary construction upon the disclosure of the patent and not the proper method of proof, irrelevant, immaterial, misleading and not complete, and not the proper procedure.

A. Whenever the by-pass valve has reached the limit of its motion in either direction, and if thereafter the governor moves the gates of the water wheel in a direction which would tend to continue motion of the by-pass valve past the limiting position which it has reached, then the effect of compensation for inertia of the mass of water in the water pipe will cease.

XQ. 478. By Mr. Westall: If this by-pass is made

of a sufficient size in proportion to the pipe-line, you have testified that the device of the patent in suit would overcome any inertia effects of the water, no matter how extreme were the variations in load. Now, suppose that this by-pass is made of sufficient size to have this effect but is so adjusted as to be normally closed. It is true, is it not, that all inertia effects caused by the closing of the by-pass valve would be taken care of, but that all inertia effects caused by the further opening of the main water gate would not be taken care of, and in such a construction, adjusted as I have suggested, the objects expressed in the specification of the patent in suit, namely, the overcoming of inertia effects caused by both opening and closing of the water gates, would not fully be accomplished?

Mr. Blakeslee: The question is objected to as merely argumentative and as based upon positions apparently contrary to the facts in the records of the case, it not being understood that this witness or any other witness has testified that any inertia effects are caused by the by-pass valve, and as therefore placing a false construction upon the facts of the case, and ^{an} ~~was~~ arbitrary interpretation upon the testimony of this witness and an arbitrary construction upon the disclosures of the patent in suit, not calling for the best evidence and not the proper method of proof, and misleading.

A. If the change in the gate opening opening the gate of the water wheel should take place immediately after a change in the opening of the water-wheel gate tending to close it, then during this period the by-pass valve would act in the same manner as if it were set partly

open and partly closed, even though its normal position would be closed. If the opening of the water-wheel gate tending to close the by-pass valve should take place, at some independent time, and not preceded by such prior closing of the water-wheel gates and opening of the by-pass valve, then, and in this case only, would the by-pass valve fail to compensate for the inertia of the water column, it being assumed that the sizes of the different parts were maintained suitable for proper compensation of the inertia effect of the water column.

XQ. 479. By Mr. Westall: If the by-pass valve is placed in normally closed position and the main water gate is open, upon an increase in load, it is true, is it not, that the by-pass cannot in any way assist in overcoming any inertia effects of the water?

A. Under those conditions and in that ~~position~~ of its travel, which I understand from the question, there would be no compensation for the inertia effects of the water column.

XQ. 480. And, therefore, part of the objects of the device of the patent in suit under those conditions would not be accomplished. Is that correct?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and not the proper method of proof, and as placing an arbitrary interpretation upon the disclosure of the patent in suit and as argumentative.

A. Under the limiting conditions of relation of parts which you have mentioned, and the specific motion of the apparatus in one direction, during its motion in this specific direction, namely, to open the water-wheel gates, that portion of the invention which refers to com-

pensation for the inertia effect in the water column would during that period not operate to correct the inertia effect of the water column.

Mr. Blakeslee: We move to strike out the answer on each of the grounds urged in the objection.

XQ. 481. By Mr. Westall: During the course of your engineering experience and since the time of your invention of the device of the patent in suit, how many water wheels have you designed or installed or assisted in the installation of or had a voice in the design, selection or installation of?

A. I have never designed any water wheels, but have been a party to the selection and installation of a fairly considerable number, which number I do not now remember. I have just finished installing six water wheels in the plant at Austin, Texas, about which I have previously testified.

XQ. 482. Have you ever recommended the adoption and use of a form of governor as described in the patent in suit for any of the water wheels which you had any part in installing or recommending?

A. Yes. In the hydro-electric plant which I designed for the city of Lynchburg on the James River, I desired, if possible, to use governors constructed on the lines indicated by the patent in suit. There however was no manufacturer making and marketing these governors, and although I prepared certain drawings and attempted to introduce these governors, I reached the decision that it would be inexpedient to attempt to get new machines made for which no patterns existed, the length of time to manufacture and delivery being indefinite, and

from strictly commercial considerations I was forced to give up the idea. As a general thing, it is improper for an engineer to install a special machine for which no patterns exist, which is not in fairly frequent use, and for which repair parts, if necessary, may not be easily and expeditiously obtained. From all these considerations I finally gave up the idea. Since no manufacturer has made machines in complete accordance with the details as shown in my patent, I have been, in my practice, forced to use the next best thing, which has been governors which produced substantially the same results by different mechanical arrangements than those suggested by myself.

XQ. 483. You have stated that in your opinion electro-mechanical governors were superior to a purely mechanical form of governor. Will you please state to what extent, if at all, electrical governors or electro-mechanical governors are used at the present time?

A. I do not know of any governors of either type that are today being commercially manufactured.

XQ. 484. Can you give any reason for this failure to use what you believe to be a form of governor very superior to those which are now in use?

A. The fact that the people who have been engaged in the governor business have in nearly every case been hydraulic engineers with a limited understanding of electricity and electro magnetic, if any. Secondly, that the production of an operative machine is not proof that intelligence of the officials of the company manufacturing it is as great as it might or possibly should be. And, further, the natural disinclination of any manufac-

turer of a specific apparatus which has become reasonably well known to change radically the character of the apparatus, carrying with it not only a change in all the patterns, designs and shop methods, but also in the instructions to the sales department as to statements to make to prospective customers which might be radically different from those which they had been previously making to prospective purchasers. All these considerations, and possibly others, bear very definitely on the reasons why the electro-mechanical governor has not been adopted in practice, even though it is a far better device. I have personal knowledge of a company manufacturing a certain character of devices, which, however, were not water-wheel governors, that purchased the patent of a far better device than the one they were manufacturing and laid the patent aside, its purchase being simply to prevent competition, and the failure to subsequently use it being based on the ground of business expediency.

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XQ. 485. Is there any governor made at the present time which does not have a returning device to prevent the governor from overrunning?

Mr. Blakeslee: Objected to as stating a conclusion, and therefore calling for an arbitrary conclusion on the part of the witness not calling for a statement of facts and not the proper method of proof.

A. I do not know of any.

XQ. 486. By Mr. Westall: It is a fact, is it not, that the returning device is an indispensable part of a

governor, and that no governor would be practicable without some such means?

Mr. Blakeslee: Objected to as indefinite and on the same grounds as last noted. There is no definition in the question of the term "returning device," and the word "device" must therefore be assumed to be a single thing which would return something, and in this question and the last, it attempts to put also an arbitrary interpretation on the testimony which has referred to a device or organization having a returning function.

A. So far as my own knowledge goes, I would consider some form of device for the prevention of over-running of the water-wheel gates and which, I understand your question to refer to when you mention "returning device", to be indispensable. It may be that there are methods of design and arrangement of parts unknown to me by which good governing could be accomplished without such device; but in the light of my present knowledge I would not know how to accomplish such governing without a device of this character.

XQ. 487. By Mr. Westall: You consider your knowledge on the subject quite extensive and your experience sufficient to qualify you to speak authoratively on the subject, do you not?

Mr. Blakeslee: Objected to as calling for a conclusion of the witness and not for a statement of facts, and not directed to determining what the knowledge of the witness is, but merely what he considers it is.

A. Yes; I consider that I have a reasonably thorough knowledge of the art of governing of water wheels.

XQ. 488. By Mr. Westall: Briefly, what is meant by "governor overrunning", or "overrunning of the governor"?

Mr. Blakeslee: Objected to as calling for a mere repetition of testimony extensively given heretofore by the witness.

A. The term "overrunning" as I have used it is meant to indicate a movement of the water-wheel gates past the position to which they should be moved whenever a change in speed occurs. This is in distinction from the movement or attempted movement of the governor when the gates of the water wheel have been fully opened or fully closed to continue motion in the direction of further opening or further closure of the gates. This latter action or attempted action I have referred to as "over-travel," and overrunning does not refer to this action of the machine, but simply to the movement of the gates under change of speed past the position to which they should be moved, but which movement is well within the limits of gate travel.

XQ. 489. By Mr. Westall: Are these sketches contained within the cover marked "Complainant's Exhibit Lyndon's Early Construction Sketches and Identifying Affidavit" in the same condition, so far as marking and sketching is concerned, as they were when originally made, or has anything in the way of marking been added thereto?

Mr. Blakeslee: Objected to as misleading if the question is to be understood as including the markings which counsel is aware to have been placed on by the witness for the purpose of identifying parts during the proceedings. We assume he excepts these from his question.

A. With the exception of the wording written on the sketches Nos. III and V at the time when I was testifying concerning these sketches on direct examination and as instructed by counsel, these sketches are identically in their original condition. I find, however, written on Sketch I in a handwriting other than my own "applies to No. 15 and 16." I also find on the Sketch II in a handwriting other than mine, "applies to No. 17." These notations I believe to have been made in the draughting room of the York Manufacturing Company, but I do not know when or by whom they were made.

Mr. Blakeslee: We again state that we do not assume that counsel wishes to confuse the record by assuming that the lettering on these sketches which the witness has placed on in his examination were on these sketches prior to such time.

XQ. 490. By Mr. Westall: There has never been a model or device of an electro-mechanical water-wheel governor constructed in accordance with the drawings and specifications of the patent in suit, has there?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness, in the first place; that it assumes knowledge by the witness as to which he is not interrogated; and, in the second place, that it assumes an arbitrary interpretation of the invention and of the construction of a mechanism embodying the same and all of the same, prior to the possibility of testifying as to whether such model or organization included such invention or embodied the same.

A. I do not know from having seen one that a water-wheel governor has ever been constructed in accordance

with all of the disclosures of my invention. I consider that nearly all of the operative governors which I know or which I have any information concerning, make use of some one or more of the elements which I have disclosed in the patent in suit. That is the answer to your question on the assumption that you refer to principles of governing. If you refer to the construction of a governor using all of the principles of governing which I have revealed in this patent, and, furthermore, the specific design of parts disclosed in it and using electro-mechanical means of operation, together with electro-magnetic speed-responsive devices. I do not know of any governor made in accordance with all of these surrounding conditions that was ever completed, although, as I have previously testified, most, if not all of the parts of one, were made, but never assembled.

XQ. 491. By Mr. Westall: Has there ever been constructed to your knowledge an electro-mechanical water-wheel governor comprising the combination with means of operating the water gate in either direction, a by-pass for the water wheel, and a valve controlling said by-pass, of means connected to the water-gate-operating means and operating the by-pass valve inversely to the operation of the water gate?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness as to an arbitrary structural proposition, not the proper method of proof and not a comparison of structure with structure.

A. Not to my knowledge.

XQ. 492. By Mr. Westall: Without quoting in its entirety the language of claim 7 of the patent in suit

(which I now place before you), I will ask you if you have ever known of an electro-mechanical water-wheel governor containing within it or comprising the combination of elements of said claim 7 or to which the language of claim 7 might otherwise be properly descriptive and applicable?

Mr. Blakeslee: Objected to on each of the grounds last mentioned, and as attempting to place an arbitrary interpretation upon the patent or the portion thereof reflected as to its meaning and import by the claim referred to, not the proper method of proof and not cross-examination.

A. I do not personally know of any water-wheel governor such as you describe in your question.

Mr. Blakeslee: We move that this answer be stricken out and withheld from consideration as to each part and parcel thereof upon each of the grounds of the objection urged.

XQ. 493. By Mr. Westall: Have you ever known of a governor for water wheels employing as a speed-sensitive device or containing within it as part of its mechanism a dynamo wound to maintain constant potential for varying currents therein but to vary the potential in a greater ratio than the speed?

Mr. Blakeslee: The same objection as last noted.

A. I do not now recall any governor having such speed-controlling means.

XQ. 494. By Mr. Westall: Have you ever heard of an electro-mechanical water-wheel governor containing within it as part of its mechanism a reversing clutch gear adapted to connect the water-gate-operating shaft and the driving shaft in reverse driving relations?

Mr. Blakeslee: The same objection.

A. Yes. The Geisler governor which at one time was manufactured by the Stillwell-Bierce & Smith-Vaile Company, now the Platt Iron Works of Dayton, Ohio.

XQ. 495. By Mr. Westall: Do you remember approximately when you heard of such a device and when it was made and used?

A. I have seen these governors in operation and, as nearly as I can remember, the first one I ever saw was in 1901 or 1902.

XQ. 496. There has never been constructed to your knowledge any electro-mechanical governor containing the precise number of magnets, solenoids, arrangement of contracts and circuits such as are illustrated in Fig. 1 of the patent in suit, has there?

Mr. Blakeslee: The same objection.

A. Never to my knowledge.

XQ. 497. By Mr. Westall: So that your explanation of the construction, operation, and of the effect, is based rather upon theory than upon any opportunity to actually observe the precise assembly of means as disclosed in the patent in suit, in operation?

Mr. Blakeslee: Objected to as indefinite and not calling for a statement of facts, and merely argumentative.

A. That statement is true providing you mean by the word "theory" the application of knowledge gained by observation of each of the different elements working as portions of other kinds of apparatus, and in which a definite knowledge of the action has become so complete as that all of the forces acting and the required

strength of all the parts are subject to mathematical calculation.

XQ. 498. By Mr. Westall: Have you ever estimated what it would cost to construct a model built in substantial accordance with the description and with the drawings of the patent in suit, by which I mean employing the dynamo described, the precise number of contacts, magnets, clutch-gears, solenoids and other devices as illustrated and numbered in Fig. 1 of the patent in suit?

A. I have frequently made such estimates and have actually had portions of such governors made, and have actually discovered by a process of having them made, and paying for them, what some of these portions would cost, so that in this way I have had a reasonable check on my estimates of cost of constructing one or two machines. As to the cost of constructing a large number of machines, this would depend so much on the number to be made of any one size or type that it would be difficult to form an estimate of the cost of manufacture of the machines as compared with the cost of building the machines.

XQ. 499. Please state what your estimate of the cost would be to construct ^{build} a model for the purpose of demonstrating the practicability of the device of the patent in suit, such model being constructed as described in my last question.

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, and not tending in any way to prove or disapprove any of the issues of this controversy, and as indefinite.

A. If by "model" you mean a sample machine capable of operating in actual practical service, I have figured that it would cost between \$1200 and \$1800 to make a small governor of a size which would be known in the trade as one having a capacity of 5000-foot-pounds. It is my belief that such a governor could be manufactured at a cost of not over \$325 to \$350, although to build an ~~additional~~ ^{initial} one would cost from four to five times this amount, and possibly more. As an illustration of what I mean by a 5000 foot-pound machine, the water wheels I have just placed in the plant at Austin, Texas, are 3000 horse-power, and the size of the governor for each set of wheels is a 17,500 foot-pound machine.

XQ. 500. By Mr. Westall: You have stated that at that time the various parts of the governor built in substantial accordance with the specifications and drawings of the patent in suit had been constructed but the parts were never assembled. Please state how nearly that model was completed before the project was abandoned.

Mr. Blakeslee: Objected to as assuming it was a model, and as not shown what "model" is intended to mean in this question. And that it is not in accordance with the previous testimony.

A. The apparatus under construction concerning which I have testified was a 5000 foot-pound machine. How far it was completed, I cannot say, except from memory of correspondence, because I never went to Kutztown while this machine was being constructed, and I therefore never saw the parts which were made there. I do know, however, that I did have a dynamo complete-

ly constructed and it was specially built by the Connecticut Motor & Dynamo Works. I also had a controller built by the Ball Electric Company of New York. These parts, however, were useless without the other portions of the machine, which, owing to the circumstances that I have previously testified about, never were completed.

XQ. 501. By Mr. Westall: These parts were useless, were they not, to the persons having them under control upon the abandonment of the project?

A. Yes; forming portions of an incomplete machine, they were necessarily of no use for any other purposes.

XQ. 502. Why was it not practical for you to secure these various parts and add those that were missing, in order to have a device which might demonstrate the practicability of the device of the patent in suit, and thereby enable you to sell the patent?

Mr. Blakeslee: Objected to as assuming facts not testified to by the witness and as misleading, namely, that the invention required such demonstrating for the purpose of selling the patent.

A. I have already explained that the portions built by the Kutztown Foundry & Machine Works were not built for me nor on my order, but were built for one W. A. Ross, who had other transactions with that same company, and of considerable magnitude, and owing to the differences between Mr. Ross and the company the company declined to deliver to Mr. Ross any of the then undelivered products it had manufactured for him. Manifestly, it was not a situation in which I could take any part. Later I opened negotiations with the Kutztown

Foundry & Machine Works looking for the purchase of these parts, for the very purpose that you have outlined. I then attempted to find a purchaser for the governor, and while I could find many engineers who agreed that the principles of my machine appeared to be of the best, they preferred to purchase from established manufacturers, possibly less efficient machines, which manufacturers could supply repair parts as the necessity would arise, without delay, and who were sufficiently financially responsible to take care of any defects in a governor, due to mechanical imperfections or flaws in material, and the possible resulting damages from accident which might come and which occasionally do come from just such conditions of mechanical defects. I suppose that there were other considerations such as the fact that it appeared that an order placed with a man in consulting professional practice without any factory and who had other interests to which he was obliged to devote most of his time, might also militate against securing a perfected device within a reasonable period of time. Whatever the mental processes of these various people to whom I offered the experimental governor were, they were sufficient to them, and I was unable to sell this machine. It would have been of no possible value to have assembled the machine on the floor of the manufactory. It could no more have proven itself effective without direct application to some water-power plant operating under fluctuating load, than would the terms of the patent specifications prove it to be a satisfactory device. If I had been the owner of a manufactory making those kinds of machinery, to which established business the

purchaser might turn at any time, I could probably have disposed of this machine. But under the conditions as they existed, it was not practical for me to do so. Therefore, it never seemed worth my while to purchase the parts from the Kutztown Foundry & Machine Works, and to the best of my knowledge and belief those parts are in the works of that company today.

XQ. 503. By Mr. Westall: It has been found necessary by the witnesses who have preceded you in testifying in the case to read in certain mercury contacts at places where they are not indicated or are not shown or described in the patent in suit. These mercury contacts, with their adjustments, are attempted to be illustrated and added to the patent disclosure in "Complainant's Exhibits AA, BB, CC" and perhaps others. Will you please state whether you agree with the witnesses to whom I have referred as to the necessity of supplying these devices to the patent in suit in order to form an operative structure, stating fully your reasons for any opinion you may express.

Mr. Blakeslee: The complainant objects to counsel attempting to summarize the testimony of any witness or witnesses who have appeared heretofore in this case, and his attempt to place an arbitrary interpretation upon such testimony of such witnesses; and we object to the question and to the witness being called upon to answer it, unless he be confronted with the testimony, if such there be, attempted to be condensed into the question, and we further, therefore, object to the question as incomplete, fragmentary and improper, stating a conclusion, and not voyaging in the direction of proper proof.

A. It will be necessary for me to know just what the witnesses you have referred to have said, before I can either affirm or deny their statements. It is understood, of course, that the means disclosed in the patent are diagrammatical or indicative and not specific mechanical designs. For instance, the contact "40" and "40a" is shown as a single-pole contact, while in the drawings "Complainant's Exhibit AA, BB and CC," blueprints, they are shown as double-pole contacts. This difference is not an actual difference at all, so far as the operation of the machine and the means of operation are concerned. An electrical contact when open tends to spark. By a proper adjustment the sparking, when the contact is broken at one single point, may be made ineffective and harmless. It, however, is easier to make a double break to keep the ^{ac}contacts from sparking. This is a mere variation in electrical design and, so far as I understand the matter of the disclosure of an invention, does not bear on the patent in suit: I mention this as an example of the variation indicated in the said blueprints from the actual single mercury contact shown in the patent drawing. As stated before, however, I do not know what testimony has been offered with respect to these blueprints. and it therefore is impossible for me to comment on any statements of previous witnesses.

XQ. 504. By Mr. Westall: Do you understand fully the construction, purpose and object of the devices illustrated in "Complainant's Exhibits AA, BB and CC," and their application to the patent in suit?

A. Not at the present moment. I have never before studied these, but believe with a few moments' attention to them I can reach a full understanding of them if they

truly represent devices to fulfill the functions called for in the specification and claims of the patent here in suit.

Mr. Westall: The witness may take sufficient time to examine and compare the blueprints referred to with the patent, in order that he may understand them before attempting to testify.

Mr. Blakeslee: In view of the last answer of the witness, we object to this question as not cross-examination.

A. I now understand the blueprints "Complainant's Exhibits AA, BB, CC," and the functions the device shown in these exhibits is intended to perform, and the relation to the patent in suit.

XQ. 505. By Mr. Westall: Will you please describe your understanding of those blueprints and their relation to the patent in suit as you understand it?

A. The double-pole contact "40", "40a" shown in the blueprints, corresponds to the single-pole contact "40", "40a", shown in Fig. 6 of the patent drawing in suit. The double-pole contact "41", "41a" of the blueprint corresponds to the single-pole contact "41", "41a" of Fig. 6 of the patent in suit. The single-pole contact "45", "45a" of Fig. 6 of the patent in suit finds its counterpart in the two double-pole contacts "45", "46" and "45a", ~~46~~^{46a} which numberings represent the equivalent of one single-pole contact. And "100", "101" and "103", "104" each numbering indicates a double-pole contact which is the equivalent of a single-contact. In Fig. 6 of the drawing of the patent in suit the contact "45", "45a" closes the circuit through the magnets "64" and "32". These single contacts all being indicated in Fig. 6 for the sake

of simplicity instead of the double contacts, and the separate circuits of magnet "32" and magnet "64" as actually shown in Fig. 1 of the patent in suit. By reference to Fig. 1 of the patent in suit it will be observed that all of the contacts are double-pole contacts, and that the lever "43" carries two pairs of such double-pole contacts, and in this way the number of contacts and their relation shown on the blueprints before referred to are in accord with the number of contacts and their relations shown in Fig. 1 of the patent in suit.

XQ. 506. What do you understand to be the purpose or object of the illustrations of the mercury cups and contacts, the mercury in the cups being shown at different levels and the contact rods in some of the illustrations being dipped into the mercury and in others being raised above it, as illustrated in "Complainant's Exhibits AA, BB and CC."

Mr. Blakeslee: Objected to as not cross-examination.

A. As I understand these three blueprints, they are meant to illustrate three successive positions of the different portions of the device. The difference in the levels of the mercury cups, is for the purpose of causing certain of the circuits to open before others of the circuits open, and cause certain of the circuits to close prior to the closing of other circuits. It is, of course, possible to adjust the level of the mercury in each of the cups to give this variation in time of opening and closing the circuit as indicated in these drawings. In my own designs I find it preferable, however, to make the projecting points attached to the levers adjustable by means of nuts above and below the levers screwing onto the threaded portions of the stud. But the principle of each

is the same. Blueprint "AA" shows conditions of normal speed of the water wheel, normal voltage of the controlling dynamo parts of the speed-controlling device in a normal and neutral position, no contact points touching the mercury, all circuits to magnets open and the governor mechanism stationary. Blueprint "BB" shows a condition of a reduction in the speed of the water wheel and a diminution in the voltage of the controlling dynamo, the pull of the solenoid on core "34" being correspondingly reduced, and the pull of spring "38" overcoming the pull of the solenoid, the downward motion of the right hand side of the lever turning about pivot "26a", contacts "41, 41a" being closed, energizing the magnet on the governor to actuate the clutch, which sets in motion the mechanism to move the water-wheel gates toward an open position. This blueprint depicts the lever either in the state of beginning to move and having closed contacts "41, 41a" or in the state of returning to normal position after governing has been completed and in which latter position it has not yet opened the contacts "41, 41a". In the position shown, the motion has not proceeded far enough to cause the contacts on the end of the lever "43" to close, or, if the parts are in the condition of returning to normal, these contacts have been opened prior to the opening of contacts "41, 41a". Therefore, there is at the instant indicated by the relation of the parts in blueprint "BB" a motion of the water-wheel gate without either of the auxiliary magnets of the governor being excited. In blueprint "CC" there is depicted the still further departure of the parts of the controlling mechanism from the normal or neutral position, and in this position the

main magnet contacts "41, 41a" and the auxiliary contacts "45, 46" and "45a, 46a" are closed. In this position, therefore, one of the main operating gate magnets is energized, motion of the governor is proceeding, and one pair of the auxiliary magnetic contacts is closed and one pair of the auxiliary magnetic contacts still open. A further displacement of the parts of the controller will cause all three pairs of contacts, namely, "41,41a" and the two pairs of contacts on the end of lever "43", to be closed, and thus energizing one of the main operating magnets and both of the auxiliary magnets. When governing is partially completed and the displaced parts begin to return to their normal position, they will move back in the inverse order as given and as depicted in the blueprints: first, the contacts "100,101,103,104" will open; next, the contacts "45,46" and "45a,46a" will open, and then the contacts "41,41a" will open, and with the opening of all three pairs of contacts motion of the governor will cease unless it is again set up by another succeeding displacement of the parts of the speed-controlling device.

XQ. 507. By Mr. Westall: Now, there is contained nowhere in the patent in suit any hint or suggestion that these contacts may be so adjusted as to provide for a succession of energization of the various magnets as you have described, is there?

Mr. Blakeslee: Objected to as calling for a conclusion and not calling for the best evidence, not the proper method of proof, the patent speaking for itself.

A. I do not find in the specification any statement specifically made concerning any such adjustment; and in the drawing it would be only indicated by the nuts

on the studs shown in Fig. 6. I am stating, however, that I consider that these studs would have to be adjustable, and in the controller which I had made by the Ball Electric Company they were so arranged.

XQ. 508. By Mr. Westall: These nuts on the studs and the studs themselves are not lettered in any way or referred to, nor their use or purpose described in the patent in suit, are they?

Mr. Blakeslee: The same objection as last noted.

A. They are not lettered, and as I have stated, I do not know that any mention is made in the specification as to the adjustability of these studs.

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XQ. 509. Prior to your idea of the construction and operation of the devices illustrated in "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1," you had not seen these blueprints, and you had not read any testimony of witnesses who had preceded you in the case concerning them or concerning the construction endeavored to be shown by them, had you?

A. I had seen the blueprints, but merely seen them: I had not studied them to determine just what actions they were intended to show. I did not know, and still do not know what has been testified concerning these blueprints and the devices which they represent, by other witnesses, further than the statement that has been made to me that one witness testified that the Girard governor was an excellent device.

XQ. 510. And the fact that you had not had any opportunity to examine "Defendant's Exhibit Berry Blue-

print No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1," accounts for your not being able on sight to fully understand the construction and operation of the devices illustrated in the exhibits referred to until an explanation thereof had been attempted and had been made by counsel for complainant in this case. Is that correct?

Mr. Blakeslee: Objected to as assuming or attempting to force an arbitrary construction of the testimony and record in connection therewith of this witness, and as assuming that any explanation was given to the witness whatsoever, the record showing that the testimony of the witness was given with respect to these exhibits upon his own perception and as a qualified engineer, of the construction and inter-relation of the parts and devices disclosed in these exhibits, plus assumptions of construction and operation and inter-relation put before him and upon which definite questions were predicated, and as merely argumentative and not the proper method of proof, irrelevant and immaterial. The record speaks for itself and is the best evidence as to the procedure in these matters by both counsel and the witness.

A. If I remember correctly, the explanation made me was simply to clear up an ambiguity which arose about the character of the drawings, and I do not now recall that any explanation of the mechanical operation or functions was made me. Obviously you are in the main correct in your statement that I would have been able to have explained the operation of the devices disclosed in these drawings or prints to which you refer, without hesitation, if I had previously studied them and had previously fully understood them. And, without

having done so, it would naturally require a little time to follow out the indications of the drawings and to get well in mind the inter-relation of the various parts so that I might be able to testify as to the operation of mechanism built in accordance with these drawings or prints.

XQ. 511. By Mr. Westall: Have you since that time read any of the testimony concerning the construction illustrated in either of the exhibits referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1?"

Mr. Blakeslee: Objected to as indefinite and not shown whether the question concerns the testimony of witnesses including the present witness, or the testimony of other witnesses than himself.

XQ. 512. By Mr. Westall: I mean the testimony of any witness who preceded you in the case and whose testimony was taken before you were sworn as a witness in the case.

Mr. Blakeslee: Objected to as irrelevant and immaterial.

A. No. I have not read any of the testimony in this case at all, and I have not been informed as to the testimony in this case except a few casual references that I do not now recall, with the single exception of one page which I read here yesterday which referred to the action of the by-pass valve. I did not glean from the testimony where the valve was located, or by whom the testimony was given. It was simply read casually, while waiting for a question to be asked me.

XQ. 513. By Mr. Westall: And concerning what

by-pass and in regard to what construction was this testimony?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and not the proper method of proof and indefinite.

A. That page of the testimony which I read did not state the type of valve nor the location nor how it operated, nor do I remember who the witness was. As I stated, it was merely a casual reading in passing a few moments waiting to be questioned. I judge from the few lines that I read that it referred to a plug-cock type of valve. This, however, was inferential, and based on the questions and answers that appeared on this page of the testimony.

XQ. 514. By Mr. Westall: Can you summarize, in a general way, what the purport of that testimony was?

Mr. Blakeslee: Objected to as irrelevant and immaterial, and calling for a conclusion and not the proper method of proof.

A. The purport of that testimony was that the valve had given trouble, first, because of grit or sand in the water. The valve had afterwards been difficult to operate because of the fit in its surrounding seat was too close. That later a looser fit was made, or, as the witness expressed it, the valve was "relieved," from which statement I judge him to have meant that a looser fit was made. And after this change in construction some of the difficulties, if not all of them, disappeared. As I have stated, my reading of this page was casual, and that is all the impression that it made on me.

XQ. 515. By Mr. Westall: Did you read this testi-

mony during the time you were answering questions, or between the times you were answering questions on cross-examination or on your direct examination?

A. It was during the cross-examination.

XQ. 516. And was it in the forenoon or in the afternoon?

A. I believe it to have been in the forenoon, or possibly just as the question of adjournment at the noon hour came up. I cannot now state definitely.

XQ. 517. Was it before adjournment or after adjournment?

A. I believe it to have been just before adjournment.

XQ. 518. Who gave you this page of the testimony to read?

Mr. Blakeslee: Objected to as assuming a fact not testified to by the witness, namely, that it was given to him by anybody. Let the witness be interrogated consistently about this, and let the endeavor not be made to lead him into a trap by unfair assumptions.

A. It was not given to me by anybody. The transcript of a great deal of the testimony was lying on the table where much of it still is now, and I picked up one of the sections of this testimony and opened it, and happened to open it at the particular page that I have mentioned, the number of which or the batch in which it appeared I do not now remember, and I read the few lines on the page which I have before referred to. I would judge that the entire time consumed in this proceeding was within the space of one minute, or possibly less.

XQ. 519. By Mr. Westall: Are you sure from the examination of "Defendant's Exhibit Berry Blueprint

No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1" that at the time you testified you thoroughly understood the operation and construction of the devices illustrated in the exhibits to which I have referred?

A. As far as they are disclosed by these prints, I feel confident that I understand the action. Of course many of the details that bear on the operation of the device which is purported to be disclosed in these exhibits are not illustrated, nor their operation indicated, in which case my conclusions as testified to would be possibly modified if such details do exist and were made known to me.

XQ. 520. Have you ever seen a device constructed in substantial accordance with "Defendant's Exhibit Cobb Blueprint No. 1," and "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness, and not a comparison of structures and not the proper method of proof.

A. No.

XQ. 521. By Mr. Westall: You have never before had an opportunity of observing the structure in which the form of the governor or part of the governor shown in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1" was used, or any construction which might be generally termed similar thereto, have you?

Mr. Blakeslee: Objected to as calling for and stating a conclusion, and assuming that the thing referred to is or ever was or ever could act as a governor and could operate at all, and calling for a conclusion upon the part of the witness as to the embodiment of any such

purported governor, and not the proper method of proof.

A. I have never seen any such device.

XQ. 522. By Mr. Westall: And have you ever seen connected with any water wheel or part of the mechanism of any water-wheel governor a plug-cock valve used in a by-pass, as illustrated in "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: The same objection.

A. I never have.

XQ. 523. By Mr. Westall: So that all your testimony concerning the operation of this device is based entirely upon theory and upon the few minutes' examination that you were able to make of "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit Cobb Blueprint No. 1," just before giving your testimony in direct examination on this subject, and is not based upon any opportunity that you may have had of observing the operation of such a by-pass valve or of observing the operation of a governor constructed in substantial accordance with either of the drawings to which I have referred?

Mr. Blakeslee: The same objection, and the further objection is registered, that the question is argumentative. The still further objection is made that the question is repetitious and has been answered on the record by the witness in his testimony as to the inoperativeness of such construction, which renders further questioning pertinent to his having seen any such operative construction improper.

A. I have never seen any such construction, and my conclusion, as given, is all based on theory. To this I

wish to add, however, that it is evident that I have conveyed to your mind the fact that I never saw any of the blueprints or the subject matter of them prior to the beginning of this cross-examination. When I stated that I had never seen them, or, rather, never studied them, I meant to be understood as referring to the governing mechanism, to the valves and to the method of operation of the machine. I had previously looked at and considered the operation of the alleged controlling mechanism shown in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1." It was the rest of the construction of the governor itself and the water-wheel valves, and other such parts, that I have never examined.

XQ. 524. By Mr. Westall: When did you examine and to what extent and how thoroughly, the construction illustrated in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1?"

A. Thursday night, March 4. The time given to it was, I should say, between five and eight minutes.

XQ. 525. And were you able in that length of time to understand the purpose of the operation of the device shown in Fig 1 of "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: Objected to as assuming that it is capable of any operation whatsoever.

A. It would not be possible for me to determine at all how the device shown in Fig 1 of "Defendant's Exhibit Berry Blueprint No. 1" was intended by its designer to act, unless some explanation were given me of the relation between the annular part "1" and the diamond-shaped piece "7". Without knowledge of whether

these were on the same or different shafts, and whether one was free and the other constrained to rotate, and, if so, which, it would be impossible to determine what the designer's idea was, because there is nothing rational in any possible arrangement of it, and for that reason the natural arrangement of parts which usually may be followed by a trained engineer on a sufficiently complete drawing could not be inferred. I was informed that the diamond-shaped piece "7" was fastened to one shaft, that being the shaft of the water-wheel represented by "8", while the annular portion or the wheel "1" was fastened to the generator shaft, and the motion of rotation or torque transmitted from the drive "8" to the generator shaft through the links "6-6", the levers "2-2". On this understanding of the arrangement, I have testified as to its value as a regulating device.

XQ. 526. By Mr. Westall: Who supplied you with the description which enabled you to testify as to the construction and operation and practicability of the device?

Mr. Blakeslee: Objected to as stating and calling for a conclusion and not in accordance with the previous testimony of the witness, and not the proper method of proof.

A. I do not remember whether it was Mr. Blakeslee or Mr. Henry. One or the other of them when asked by me how this device was intended to be applied, informed me as to which parts were fastened on each of the shafts, as I have just before testified to. No information was given me and no suggestions offered me as to the resulting action of any such mechanism built in the manner previously set forth. On the contrary, my

opinion was then asked as to what would be the result of such a combination of parts so applied to a driver and driven mechanism.

XQ. 527. By Mr. Westall: How much time was consumed in explaining the features of construction and operation of the device illustrated in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1" before you attempted to testify concerning such device?

Mr. Blakeslee: Objected to as misleading and as assuming facts contrary to the very testimony of the witness, namely, that the operation of the device, even assuming that it were operative, was attempted to be put before him at all. His last answer has shown the contrary of any such assumption.

A. The time taken to explain to me how this device was applied to a water-wheel shaft and dynamo shaft could not have been more than the length of time it would require to utter say one hundred words. I should judge that it was all within the period of one minute. How much shorter time than this, I could not say. I do not believe that the entire discussion of this device consumed more than eight minutes, and I believe not more than five minutes.

XQ. 528. By Mr. Westall: So that your previous examination of Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1," of not to exceed five minutes, and an explanation of perhaps a minute, was sufficient to enable you to understand the operation of the device sufficiently, in your opinion, to describe it as fully as you have done in your testimony. Is that correct?

Mr. Blakeslee: I object to the question as misleading, the witness having testified directly against any such

disclosure of purported operativeness and as against the operativeness of this device. We protest against this attempt to return the testimony of the witness to his ears in a garbled form, and tempt him to accept that as his testimony.

A. The length of time that you mention, together with the seven and a half years spent in technical colleges, and some twenty-three years of subsequent experience, all taken together, enabled me to reach a conclusion at the time mentioned and within the time stated as to the forces acting under different conditions and the resulting displacement of the moving parts of such a device. In explanation, I may say that there is not an obscure mechanical action or reaction in the device shown in Fig. 1 of "Defendant's Exhibit Berry Blueprint No. 1."

XQ. 529. By Mr. Westall: Are you sure that you now understand perfectly the construction of the bypass valve and its operation and the construction of the water gates and their operation as the same are illustrated in "Defendant's Exhibit Berry Blueprint No. 1"?

Mr. Blakeslee: Objected to as assuming facts contrary to the testimony of the witness, namely, assuming that there is any operativeness attaching to these devices whatsoever, and as stating a conclusion and calling for a conclusion, and not the proper method of proof.

Mr. Westall: I wish my question to be limited, if you do not understand it so, to the construction of the valves themselves and not of their connecting means by which they are operated.

Mr. Blakeslee: The same objection.

A. I understand the general characteristics and the types of valves shown. Undoubtedly there are details of construction which I do not understand, because they are not disclosed by the drawings. For instance, in the water-wheel valves the relation between the plug itself and the surrounding seat appears to be indefinite. In the case of the by-pass valve, while the arrangement of plug and seat as indicated by the section through some point in the axis of the valve is clear, I have no means of knowing what the end arrangements are.

XQ. 530. By Mr. Westall: Referring to "Defendant's Exhibit XX," showing a perspective view of some of the parts about which you have been testifying in your last answer, is there anything in that perspective view or photograph which would enable you to testify more definitely concerning the construction of this by-pass valve?

Mr. Blakeslee: Objected to as assuming any identity between these two showings, and as therefore calling for a conclusion on the part of the witness, and not the proper method of proof and as testimony on the part of counsel attempted to be put in the mouth of the witness.

A. Assuming that the perspective view which you have handed me relates specifically to the by-pass valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1," and further assuming that the portion lettered "J" in the before-mentioned perspective view is the same by-pass valve, I can now state that I fully understand its general construction as to the end parts. I still, however, am without information as to whether the

plug and seat of the valve are tapered or whether they are of a constant diameter throughout their length.

XQ. 531. By Mr. Westall: Assuming that the plug is of constant diameter throughout its length, will you please describe the device as you now understand it, by a reference to the two exhibits referred to, namely, "Defendant's Exhibit XX," and "Defendant's Exhibit Berry Blueprint No. 1?"

A. The valve case or body comprises a cylinder the diameter of which I am unable to give, which is machined throughout its length. Openings are formed in the body of the cylinder through two of its opposite sides, that is, the center lines of these openings are at opposite ends of the diameter through the cylinder, and the ends of the cylinder are machined smooth also. A plug having a length substantially equal to the length of the cylinder and machined on its periphery so that it forms a smooth cylindrical surface, is placed endwise into the cylindrical casing and is adapted to fit inside of this casing, being rotatable therein. A hole or opening is made through this plug, which enters at one side and passes out at the other side, the center line of the opening, taken from element to element of the plug, corresponding to a diameter of the plug. The length of this opening, compared to the length of the plug, I am not able to say, but proper mechanical design with due regard for economy of construction would require that the length of this opening be at least 75% of the length of the cylinder. On one end of this plug is fastened a shaft, the axis of which coincides with the axis of the plug. A lever is fastened to this shaft and, obviously, movement of the lever will cause rotation of the plug. When the

plug is rotated so that the opening through it corresponds with and registers with the openings through the sides of the surrounding valve body, there is provided a free passage through the entire structure, while if the plug is rotated so that all portions of the opening through the plug on either side of the plug are surrounded by the valve casing, then no passage is provided through the said structure. This latter condition is depicted in the cross-section shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1." These described portions cover all of the parts of the valve excepting the end portions. As indicated in the perspective picture, "Defendant's Exhibit XX," the two ends of the valve are covered by discs or circular plates obviously of cast-iron, the surfaces which come in contact with the end of the case and end of the plug being machined smooth. These discs are bolted in place by the usual mechanical arrangement of studs or machine bolts. One of the discs is provided with a hole through its center, through which the operating shaft may pass, and a stuffing box to prevent leakage appears to be a portion of this device, though this is not clear from any of the pictures or drawings of it.

XQ. 532. Now, we have assumed that this plug within the casing forming the by-pass valve was of the same diameter throughout its length, that is to say, was a cylindrical plug. Is there any indication on either "Defendant's Exhibit Berry Blueprint No. 1" or "Defendant's Exhibit XX," which would lead you to believe that this plug was not cylindrical or was not of the same diameter throughout its length?

A. No. The indications are that it is of the same

diameter throughout its length; and, if it were not, and the plug were conical instead of cylindrical, the drawing Fig. 4 would be incomplete. The perspective drawing "Defendant's Exhibit XX," would indicate that if there were a taper of the plug that this taper would not be considerable, but that the slope of the sides would be comparatively small.

XQ. 533. Would not the fact that the outside casing shown at "J" in "Defendant's Exhibit XX," is cylindrical throughout its length indicate strongly that the plug contained therein was cylindrical and of the same diameter throughout its length?

A. It would be an indication which would warrant that assumption. It, however, is frequently true that where the internal taper of a body the cross-section of which at any point is circular is comparatively small, that is, the slope of the sides is small, the outside of the structure may be made cylindrical simply because of the greater ease of making patterns and castings of that form, and in such case the rough casting would come from the foundry as a cylindrical body both inside and outside, and the internal taper or conical form would be given by machining it.

XQ. 534. In other words, it would take more time, trouble and expense to make the plug and the interior of the casing conical than it would to have it cylindrical. Is that correct?

A. Yes; in a measure that is true.

XQ. 535. Now, in the construction which you have been describing, namely, the by-pass valve illustrated in "Defendant's Exhibit XX," and in "Defendant's Exhibit Berry Blueprint No. 1," there would be no advan-

tage, would there, in having the plug within the casing "J" in "Defendant's Exhibit XX," conical, but there would be a distinct advantage in having it cylindrical, in that it would be more easy to make and there would be less time, trouble and expense in machining the interior of the casing "J" as well as machining the exterior plug. Is that correct?

A. It is partly correct, in that the cost of making parts tapered, would be slightly greater than the cost of making the parts cylindrical. And assuming the same fit to be made between the tapered type of valve and the cylindrical valve and the openings to be the same, the operation of the two would be identical and there would be no advantage of either over the other so far as the working is concerned. But there is a distinct advantage which the tapered plug has in practice, namely, that the tightness of the fit may be adjusted to any desired degree and wear may be compensated for by merely adjusting the plug farther in or out of the surrounding casing. But if your question refers to the respective operation of the two variants of this type of valve, there is nothing to choose between them when the are both adjusted in operating condition.

XQ. 536. Now, a by-pass valve of the plug-cock type, used for the purpose as evidently intended in "Defendant's Exhibit Berry Blueprint No. 1" and in "Defendant's Exhibit XX," would not require any very close or accurate fitting of the valve within its casing? That is to say, the escape of a small amount of water continually through the by-pass valve even when closed, would be of no particular moment? Is that correct?

A. Yes. That is not only true, but I should judge

that the comparative looseness of fit would be absolutely essential to the operation of this valve.

XQ. 537. And that would also be true of the butterfly type of valve which is illustrated in the patent in suit, would it not? That is to say, there would be an escape of some water at all times even when the valve was closed?

A. There is no question but that there would be a slight leakage. The escape of water would be of a negligible order. To illustrate this point more definitely, a butterfly valve in a by-pass having a capacity to discharge 100 cubic feet per second, should not have a leakage of over two to five gallons per minute when fully closed. That is, the percentage would be of an order of 1-100 of 1 per cent of the capacity of discharge.

XQ. 538. Now, assuming for the moment, contrary to the indications of "Defendant's Exhibit XX" and Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1," that this plug within the casing is in slightly conical form and that the means for its adjustment are located outside of the casing adjacent to the disc through which its operating shaft would extend. Will you please state whether or not if the valve were found under one adjustment to work with too much friction within its casing that it would not be easily possible to obviate this friction by reducing, by means of the adjusting means, so as to make the valve to move very easily within its casing, considering the purpose and object of the device and considering the fact that the slight escape of water would be of no particular moment?

Mr. Blakeslee: Objected to as irrelevant and immaterial, and not even upon the hypothesis presented rele-

vant or material to the issues of this case, the assumption being of a structure not before us in connection with the exhibits under discussion, and not tending one way or another to prove or disprove any issues of this case, and as merely argumentative and not the proper method of proof.

Mr. Westall: It is admitted, of course, that the exhibits referred to clearly show this conical form of construction not to have been adopted; but this is simply a hypothetical question which I believe would aid the court in understanding the purpose and operation of the plug-cock valves generally and would, therefore, be pertinent to the issues.

Mr. Blakeslee: If the question is to be viewed in the light of the last admission or statement, or both, the question is further objected to as not the proper method of proof and as not cross-examination, and particularly not cross-examination in rebuttal, the defendant having had its opportunity to present, if it be proper matter in defense, the question of valve types. It is merely an academic discussion without any benefit to the case in view of the structures entering into the exhibits before us, namely, "Defendant's Exhibit XX" and "Defendant's Exhibit Berry Blueprint No. 1."

Mr. Westall: Do I understand by the last remark of counsel that he admits that the construction shown in the exhibits referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1" and "Defendant's Exhibit XX" show that the plug within its case is not conical but is of cylindrical form?

Mr. Blakeslee: No. We make no admission. We are simply quoting the admission of counsel for defendant.

Mr. Westall: Would it be counsel's contention that this plug is of conical form, or cylindrical?

Mr. Blakeslee: We will say when we come to the argument what we can make out of the evidence presented in these respects. We are not prepared to limit ourselves at this time by any prediction in that particular.

A. If the plug and surrounding casings were conical and the adjustment which you mention were provided, which arrangement is a very common and usual construction in plug-cocks, it would be easy to relieve the plug of all friction which might proceed from the wedging action, due to drawing it tightly into the surrounding casing. By no amount of adjustment, however, could the plug be relieved from friction that would proceed from the pressure of water against it, as this pressure would remain substantially constant for any degree of adjustment of the plug into or out of the casing within the limits of usual and operative practice.

XQ. 539. By Mr. Westall: And your idea is simply that this water pressure would press this plug down, to get away from technical expressions, into the bottom of its casing, and therefore compel a friction, no matter what adjustment was made with the adjusting means, assuming that it was made in conical form and was not supported in any manner at the end opposite to that in which this operating shaft protrudes?

Mr. Blakeslee: Objected to as indefinite and incomplete and merely argumentative, academic, and not bearing on the issues presented, and not pertinent to the matters now under consideration.

A. Yes; that is true, not only of the plug-cock you have mentioned, but of every type of unbalanced valve

which is known, whether flat-sliding, round-sliding, round-rotating, or any other type of unbalanced valve.

XQ. 540. By Mr. Westall: Now, when you use the term "unbalanced" applied to a plug-cock valve and to a butterfly valve respectively, what do you mean?

A. The plug-cock valve is unbalanced in that a frictional resistance to motion, due to unbalanced water pressure, is set up, and herefore not only the normal friction of the co-acting parts of the valve must be overcome, but also the frictional resistance produced by the water pressure. This frictional resistance taking place over one-half of the area of the valve itself is of an amount and degree proportional to the size and opening of the valve. In the case of the butterfly valve, there is a frictional resistance to motion produced by the water pressure against the disc, but this frictional resistance does not take place over the surface of the valve itself. It simply acts against the bearings of the shaft on which the disc is placed, so that the frictional resistance to motion has such a small lever arm and travels over such a small distance that it becomes practically negligible. In the case of the butterfly valve the forces acting, due to water pressure, are always in balance, and there is no resistance to motion of the valve disc because of unbalanced moments of the forces on the portions of the disc on either side of the shaft. In other words, considering one-half of the disc as being above the shaft and the other half of the disc being below the shaft, the moment of the forces acting around the shaft on the upper side of the disc will always be equal to the moment of the forces around the shaft acting on the lower side of the disc.

XQ. 541. Under your understanding and definition of the term "balanced valve", do you wish to be understood as saying that you consider the by-pass valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" and "Defendant's Exhibit XX," not to be a balanced form of valve?

A. In so far as your question refers to unbalancing of pressures acting due to water pressure and tending to resist motion of the valve in either direction or ~~tending to resist motion of the valve in either direction or tending~~ to cause motion of the valve, it not being intended to include by these statements frictional resistance, the plug by-pass valve is a balanced valve. The general expression "balanced valve" is meant to convey the idea that there is no substantial change in resistance to motion, whether there be a water pressure applied to the forces or whether there be no water pressure acting on the valve. In other words, the mechanical difference is that a balanced valve is one which is easy to move and the ease of which movement remains substantially constant regardless of pressures to which the valve may be subjected. This use of this term broadly is justified because the object of the use of all balanced valves is to obtain a free-moving valve and one that is not difficult to move, whether actuated manually or mechanically. In this particular mechanical sense, the plug type of valve is not a balanced valve because of the considerable frictional resistance which is usually inseparable from their form of construction.

XQ. 542. For the sake of clarity, I will ask you to state briefly why you consider the type of plug-cock

valve illustrated in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" a balanced valve?

Mr. Blakeslee: Objected to as stating a conclusion contrary to the testimony of the witness, and, therefore, impossibly calling for a statement of facts by the witness.

A. In the sense that it meets the general mechanical understanding of a balanced valve, the plug-cock referred to is not a balanced valve. In the sense that there is little or no resistance to motion of the valve due to the moments of forces tending to rotate the valve in one direction or the other by the action of the water pressure which is passing through the plug-cock, it would in this narrow sense be termed a balanced valve. This, however, would in no wise change the fact that the valve must possess considerable frictional resistance to the motion due to the water pressure and that the force required to move the valve under a very light water pressure must be much less than there is required to move the valve under a heavy water pressure. Therefore, the object of a balanced valve, namely, ease of motion under any water pressure and resistance to motion, substantially independent of water pressure, is not fulfilled by this construction.

XQ. 543. By Mr. Westall: To get right down to the sum and substances of the matter, the reason why the plug-cock valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" you would not consider to answer all of the definitions and requirements of a balanced valve is on account of the friction of the plug within its casing. Is that correct?

Mr. Blakeslee: Objected to as stating a conclusion

and not calling for a statement of facts, merely argumentative, not the proper method of proof.

A. Yes; that would ~~would~~ be the principal objection.

XQ. 544. By Mr. Westall: That really is the entire objection, is it not?

Mr. Blakeslee: The same objection—not those mentioned by counsel, but the objection last mentioned of record.

A. No. There are other objections to this form of valve.

XQ. 545. By Mr. Westall: I am not speaking of objections to the form of the valve, but I am speaking of reasons why it might not be considered a “balanced valve.”

Mr. Blakeslee: The same objection, and the further objection that it is calling merely for repetition, the witness having stated exhaustively with respect to the characterization of this valve.

A. Yes; the friction due to water pressure and to the weight of the plug, even assuming that the pressure between the plug and the case when no water pressure is acting on the structure, is comparatively small.

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XQ. 546. Will you please state why in your opinion the term “balanced valve” is properly applicable to a butterfly valve such as shown in the Lyndon patent in suit?

Mr. Blakeslee: Objected to as having already and distinctly been answered.

A. All the forces set up by the water pressure and acting on the parts of the valve are balanced by equal forces acting oppositely thereto produced by the same

water pressure. Also, the friction which proceeds from water pressure is limited to the friction of the axis of the valve in its journals, and there is no frictional relation between the valve and its seat. Hence the effort required to move the valve with a considerable water pressure on it does not appreciably vary from the effort required to so move the valve with a very small water pressure on it, and, for this reason, it comes within the mechanical ~~expectation~~^{accept} of the term "balanced valve."

XQ. 547. By Mr. Westall: Now, you have been assuming, have you not, that the plug of the by-pass valve illustrated in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" at "41,42,43" is either conical in shape and is adjusted by means outside of the casing at the point where the plug is connected to its operating shaft, and was not in any way supported within the case except by the bearing against the sides of the casing. Is that true?

Mr. Blakeslee: Objected to as indefinite and not specifying in what particulars or relations such assumptions lie.

A. Yes; I have considered it as a valve in which the plug was supported by the casing with which it co-acts. This has been a necessary assumption as, if it were not supported by and in contact with its casing, it would cease to be a plug-cock type of valve.

XQ. 548. By Mr. Westall: You mean to say that if it was supported at the end of the case opposite to that through which its operating shaft extends by a trunnion in a bearing of any kind, so that its periphery would not come in contact, necessarily, with the sides of the casing that it would not be a plug-cock valve?

Mr. Blakeslee: Objected to as indefinite and as assuming an incomplete and fragmentarily disclosed construction, and as assuming a devisible structure with a support at one end and no definition of support at the other end, and, therefore, indefinite and problematical in nature, and as argumentative and not the proper method of proof.

A. If the plug was supported at the end opposite from the end to which the lever is attached, and should swing clear of the surrounding casing, it would, of course, be equally necessary that it be supported on the end to which the lever is attached. The condition of the shaft to which the operating lever is fastened forming a support for the plug would be an unusual structure, and I have personally never known or heard of any such structure. Assuming, however, that I understand your question to refer to a plug supported at both ends upon a trunnion at one end upon which it rotates, adequately supported to take the thrust of the water pressure, and on the shaft to which the lever is attached at the other end, which also passes through a bearing in addition to the side of the box, so that it too may take the thrust of the water, the diameter of the plug at any point along its axis being slightly less than the diameter of the surrounding casing, so that at no point does the plug contact with the surrounding casing, then I would consider that the valve had ceased to be a plug type of valve.

XQ. 549. By Mr. Westall: And your testimony concerning the alleged impracticability of a plug-cock valve in such a position, as illustrated in Fig 4 of "Defendant's Exhibit Berry Blueprint No. 1," would not be applicable to the structure shown in the figure re-

ferred to if the plug of that valve is supported at each of its ends and rotates freely on this axis without contact with the sides of the casing. Is that correct?

Mr. Blakeslee: Objected to as placing an arbitrary interpretation upon the previous testimony of the witness and as stating a conclusion and calling for a conclusion, and as argumentative, not the proper method of proof, and not calling for a statement of facts.

A. As long as there would be no contact between the plug and the surrounding casing and no wedging action between the two by the introduction of sand, leaves, grass or other foreign substances such as are frequently entrained in the water fed to the hydraulic plant, and assuming further that the space between the ends of the plug and the end covers of the valve were sufficiently great to also give an appreciable clearance between the two, and that the amount of water flowing continuously through these clearance spaces both at the ends and around the plug were not too great a proportion of the total flow in the penstock, then the objections as to the high frictional resistance about which I have testified would be practically removed.

XQ. 550. By Mr. Westall: And such valve would be a balanced valve, would it not, with the definitions you have previously given of such a balanced valve?

A. I would so consider it.

XQ. 551. And in that respect it would not differ, so far as principle of operation is concerned, from the butterfly valve, would it?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts and not the proper method of proof.

A. Its operation would not be substantially different from that of the butterfly valve if, as I have stated, no wedge action is produced between the plug and its seat by the introduction of any foreign body. Assuming that the valve is always absolutely clean and there is no possibility of entry of entrained silt which might form a deposit, or any other foreign substance, and the plug and surrounding casing be always free, with respect to each other, then the operation of this valve would be substantially of the same character with respect to frictional resistance as the operation of a butterfly valve.

XQ. By Mr. Westall: And any weight of water in the construction that has been under discussion in the last two or three questions, namely, that in which a cylindrical plug of a by-pass valve is supported and rotates at both of its ends upon a shaft or trunnion, would be borne by the shaft and trunnion in exactly the same manner that any weight of the water would be borne upon the bearings of the butterfly valve upon which it rotated. Is that not true?

A. Yes.

XQ. 553. I call your attention to Fig. 2 of the drawings of "Defendant's Exhibit Berry Blueprint No. 1," to the dotted lines adjacent to the parts or comprising in the part numbered "41,42,43" and "46", and ask you to state whether you understand the construction there illustrated?

A. While the meaning of the lines is not quite clear, owing to the wide distance of separation at the points of the dashes of which the dotted lines are made, I believe I understand the construction there indicated.

XQ. 554. Will you please describe that construction as you understand it and state what the dotted lines are intended to illustrate.

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness as to any intention of illustration. All the witness can do is to make out what he finds there, without knowing what was in the mind of the man who made this blueprint two months ago.

A. My interpretation of these lines is based on the assumption that they represent a by-pass valve operated by a lever, and that the cross-section through this by-pass valve is the same as shown in Fig 4. Whether this assumption is correct or not, I cannot say, but it would be my natural inference from a study of the print "Defendant's Exhibit Berry Blueprint No. 1." This appears to show a rotating valve, but the numbers of the parts in the two figures, namely, Fig. 2 and Fig. 4, for instance, "41" in Fig 2 apparently shows the eye of a lever attached to the operating shaft "42", while in Fig 4 "41" apparently refers to the plug or moving cylindrical portion itself. Now, with the assumption that this difference in numbering on the blueprint is erroneous, and judging as well as I can from the dotted lines, I believe that these dotted lines represent a rotating valve operated by a lever on one end, though I cannot determine whether the operating shaft has any bearing to support it, nor whether it has a stuffing box outside of the bearing. In the absence of the indication, so far as I can see, of a stuffing box, I would be inclined to believe that there was no separate bearing and that the operating shaft "42" does not fit tightly in the hole through the end cover plate of the valve, and through

which this shaft passes, because the absence of a stuffing box indicates that the valve is tight to its periphery. If it is so tight to its periphery, there is no need of a stuffing box. Passing through the plug from one side to the other is the opening which I take to be the same opening as that indicated in the cross-section shown in Fig. 4. On the other end of the valve opposite to that through which the operating shaft passes, there also appears to be a cover plate. In the center of this cover plate is a projecting central portion, and whether or not it forms a bearing for a trunnion, I am not definitely able to say. It looks as if this might be the intention. It, however, is true, that castings are frequently made in this form without there being anything made to fit in the central portion, the reason being that this casting, when not bored through, may be used for end plates without holes through them or, if bored through, become plates through which a shaft may pass with a surrounding boss provided. That is to say, I believe that the cover plates at each end of the valve have been cast from the same pattern. This might have been simply for convenience to prevent a duplication of patterns or parts, or it might have been with the definite object of placing a trunnion in the cover plate opposite to that through which the operating shaft passes. On this latter point the drawing is not quite clear. And before giving an absolute opinion on this part of the subject I would prefer to know what statements, if any, have been made by the previous witnesses who knew what this construction was in practice, and who prepared this drawing. In other words, there might or might not be a trunnion on

the left-hand side of that valve, and the drawing does not clearly indicate which.

Mr. Blakeslee: It is to be noted that this question and answer deal almost entirely with the dotted line showings in the blueprint which are not elevation showings and not, therefore, the best evidence in any respect in drawing practice of shape of construction or interrelation of parts, and the whole question and answer are objected to as being founded purely upon hazard and guess, in spite of the best the witness is able to do on the subject.

Mr. Westall: I suppose that counsel would be willing to have the language he has used in his last objection or statement of record applied also to the dotted lines showing the alleged by-pass valve "48" in the patent in suit.

Mr. Blakeslee: No. My position is this: that there is a vital difference, namely, the purported valve of the "Berry Blueprint No. 1" is attempted to be shown in elevation and section and apparently was a particular feature of the construction which the draughtsman thought necessary to illustrate in body lines, and the best evidence, therefore, is the body line showing that of this purported valve. Whereas the by-pass valve "48" of the patent in suit is shown as a generally well-known type of valve and is then shown, as it is customary to show such things, there being draughtsmen's methods of showing standard constructions without body-line drawing. The distinction is, therefore, that the draughtsman has attempted to show us what this valve is in the blueprint, and that is the best evidence obtainable from the blueprint of what that valve is. The

query is why he did not give us a longitudinal section of this valve.

XQ. 555. By Mr. Westall: Now, a study of the dotted lines surrounding or adjacent to "43" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1" shows very clearly, does it not, that the valve is not conical, but that the plug of the by-pass valve is cylindrical?

Mr. Blakeslee: Objected to as assuming that this is a by-pass valve, and as assuming anything from the showing of the drawing of the blueprint, which speaks for itself, and is therefore stating a conclusion.

A. Study of that drawing conveys to my mind the idea that the plug and its surrounding casing are of the same diameter at any point along the axis.

XQ. 556. By Mr. Westall: If you are correct in believing from the drawing referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1," that the plug and its casing of this by-pass valve is of the same diameter throughout its length, then it is very easy to assume, is it not, that there would be no reason for the adjusting means of a conical plug on the outside of the casing such as you have described?

Mr. Blakeslee: Objected to as argumentative and not calling for a statement of facts, and as a statement of conclusion based upon the blueprint showing, such as it may be, and not the proper method of proof.

A. Under the conditions you mention there would be no need of any means to adjust the valve longitudinally in its casing.

XQ. 557. By Mr. Westall: And to support the end of the plug opposite its operating shaft on a trunnion in

a bearing would be a most obvious mechanical expedient, would it not, in such a construction as that shown in "Defendant's Exhibit Berry Blueprint No. 1?"

Mr. Blakeslee: The same objection.

A. Not in that type of valve. In fact it would be difficult for me to conceive of the arrangement of a rotating valve that was not supported by its seat and did not contact with it. I do not know of any character of rotating valve at all that does not make full contact with its seat along the whole length of the valve and over all that portion of the circumference of the valve which is not cut away to allow a passage of fluids. The construction of a valve which would have a trunnion at one end and a shaft at the other about which it would turn and be supported and at the same time make contact or even a reasonable fit with the valve seat, while not impossible to make would be a difficult mechanical construction; and if the idea of supporting the valve on a shaft had ever come to my mind, as, in fact, it did, when I made the invention, it would have equally removed from my mind, if it had existed, the idea of using a cylindrical plug or rotating portion working and co-acting with a surrounding cylindrical case. In other words, so far as my own judgment and my own ideas would go, I can see no mechanical excuse for making a valve of this type, because of the mechanical difficulties of producing a properly working mechanism. I do not mean by this to state that if such a valve were made that it would be inoperative. It simply would not, to my mind, be good mechanical design, as other and cheaper types of valve would fulfill the same condition, and, at the same time, be free from objections that must obtain with a con-

struction such as you have described. Therefore, it would not be obvious, to my mind, to take a plug valve and then support it on a trunnion and shaft.

XQ. 558. By Mr. Westall: When you first examined "Defendant's Exhibit Berry Blueprint No. 1" you did not examine it carefully enough to know with the positiveness that you now know upon being referred to Fig 2 of said drawing, that the plug within the casing was cylindrical? Is that correct?

A. As I have testified, I was reasonably certain from reference to "Defendant's Exhibit XX," and to the absence of any lines on Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" that would indicate a conical shape of plug, that the plug must be cylindrical. Fig. 2 of "Berry Blueprint No. 1" if I have interpreted the lines correctly, further indicates this, and in this manner it is cumulative, and undoubtedly is another indication additive to those that I have described. I believe that I was clearly of the opinion that the plug is cylindrical before referring to Fig. 2 of the drawing of "Defendant's Exhibit Berry Blueprint No. 1" as I have been since referring to it.

XQ. 559. Would not the fact that the plug of the by-pass valve shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" if not supported by a trunnion, and it being in frictional contact within its casing, would be likely, as you have testified, to make such valve difficult of operation, and, perhaps, impracticable, and taken in conjunction with the fact that a trunnion at the end of the plug opposite the operating shaft, both operating shaft and trunnion being supported in bearings, would obviate these undesirable results, and taken in conjunc-

tion with the fact that there is distinctly shown at the point which I have marked "A" in red upon "Defendant's Exhibit Berry Blueprint No. 1," Fig. 2, what might be such a trunnion, lead you to the conclusion that it was very likely the intention of the designer of this apparatus, and it was very likely the construction and operation of the device, that this plug should be so supported and kept from friction with its casing?

Mr. Blakeslee: Objected to as attempting to place an arbitrary interpretation and translation upon the blueprint under discussion, and as merely argumentative, and not calling for a statement of facts, but, rather, calling for a conclusion; and, furthermore, as calling rather than for testimony of expert advice by the witness, which it is too late for the designer of the showing of this blueprint to utilize, however much it might have been to his advantage and the advantage of any persons who attempted to utilize such structure, to follow the advice of the witness as an expert engineer.

A. I would not reach that conclusion, for this reason: The type of valve which is shown in cross-section in "Defendant's Exhibit Berry Blueprint No. 1", Fig. 4, is, to my mind, so obviously an improper construction to accomplish the purpose which a by-pass valve should accomplish, whether it be a plain plug valve or whether it be a circular rotating piece supported on a shaft or shaft and trunnion, that I would not infer that it would be logical or reasonable mechanical design to take any step in any direction with it. If difficulty had been experienced with the operation of the valve as a plain plug type of valve, it would have been the natural and logical thing to remove this valve entirely and substitute some

other form. I would not have considered it advisable or good designing to attempt to rearrange the parts, to produce the structure which you have described. Furthermore, regardless of the quality of the water which would pass through the by-pass valve and its freedom from silt or sand, I would also have feared wedging between the valve and the surrounding casing by some possible floating foreign body such as grass or leaves or small twigs, any and all of which frequently pass through pipe-lines, and although they pass with ease through the water-wheel gates and are not detrimental to the action of the water wheel, the liability of wedging the plug would have appeared to me a prospective and constantly impending danger.

XQ. 560. By Mr. Westall: I believe the witness must not have understood the question fully. What I am endeavoring to ask, is, that taking the fact, if it be a fact, that a plug of the size of that shown in Fig. 4 of Defendant's Exhibit Berry Blueprint No. 1," might be very difficult to operate if it were not supported at both ends ^{of the} by shafts or trunnions, together with the fact that if such a plug were so supported it would be easy to operate, and would obviate all the objections to the lack of balance which you have urged against it, in conjunction with the fact that there is shown at the point which I have marked "A" in red in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," a part ~~of~~ which might be a trunnion and which appears to have been intended for that purpose, leads you to the conclusion that in the construction illustrated in the exhibit referred to it was intended to show and does show that the cylindrical plug

is supported at both ends upon bearings, and does not necessarily come in contact with its casing?

Mr. Blakeslee: The same objection, and, further, that it is going directly in the face of the testimony of the witness which is to the effect that in Fig. 2 such showing as there may be as to this rotating valve indicates a direct peripheral contact of the rotating valve with its casing.

A. As I have testified, the projection shown to the left from the center of the left-hand end cover of the valve, may indicate a trunnion. I cannot state definitely that it does indicate it. I cannot consider this one indication alone. It is necessary for me, in order to form an opinion upon the structure, to consider all of the structure so far as it is revealed by this drawing; and also other drawings which have been submitted in evidence may have the tendency to influence my view of what this drawing does represent. The absence of any stuffing box on that drawing indicates that the plug and surrounding casing are in contact. Also the natural inference that would follow, that this type of valve always has its plug and casing in contact, would require more than ever that an indication of the absence of this contact be shown in drawings, in which case additional lines would be shown which would be parallel to the axis of the plug and very near to the lines which mark the inner wall of the cylindrical surrounding casing. These lines are absent. And while it is also true that in the dotted line indications of a device, that sometimes certain of the lines may be omitted, it is equally true that were these dotted-line drawings mere indications, it would be difficult to decide definitely about the details of the

construction which they are intended to represent. I have had placed before me at another time in this examination the perspective picture of a device which I understand to represent this identical construction as built and installed, and which is marked "Defendant's Exhibit XX." The absence of any trunnion on the side which is opposite to that of the operating lever is so clear that it is difficult for me to conclude that the dotted lines on the drawing shown in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1" are meant to indicate a trunnion. It is possible that subsequent to the construction of this device as shown, and in the light of possible experience which may have been had with the attempt to operate this valve, that the draughtsman concluded that a trunnion would be an improvement and actually meant to indicate it. These, however, are mere surmises on my part, and it is impossible for me to speak definitely on these portions of the subject.

XQ. 561. By Mr. Westall: If in addition to the indications which were pointed out in the last question you were told by those who had designed and installed and had actually observed the operation of this device that there was no such friction between the plug and its casing, and that the plug operated perfectly within its casing without any friction, would you be inclined to believe, if you thought such witnesses were speaking the truth, that the part that I have marked "A" on "Defendant's Exhibit Berry Blueprint No. 1" was intended as a trunnion?

Mr. Blakeslee: Objected to as being purely an arbitrary condition which at best can only call for a conclusion on the part of the witness and which may tend to

force an arbitrary construction upon the testimony of other witnesses, not calling for a statement of facts by the witness, but merely a deduction or formation of belief upon his part which is not testimony as to his knowledge, not the proper method of proof, and merely argumentative; and, furthermore, as not taking into account all the working conditions which may or may not have entered into the attempted operation of this device after it left the shop where it was experimentally constructed.

A. As to whether or not I would conclude that a trunnion were placed on one end and supported on a shaft on the other end, would depend on my knowledge of the operating mechanism, for this reason: the operation of a plug valve without any supporting means, even such a one as indicated in the drawing "Defendant's Exhibit Berry Blueprint No. 1," is not an impossibility if the operating means be made strong and heavy enough.

Without knowing whether these operating means were strong and heavy enough to force rotation of the valve and overcome the heavy frictional resistance, I would be unable to agree that there must have been a trunnion in the position you mention. If, however, ordinary, reasonable, commercial means were available, and by that I mean a water-wheel governor of approximately the same size as would be required, if there were no bypass gate to be operated, and were the only means available, and this valve worked rapidly without causing dragging of the mechanism and produced satisfactory regulation, I would then conclude that the plug was supported on a trunnion and shaft as you depict, or supported in some other method, and that it would certain-

ly not be in frictional contact with its surrounding casing.

XQ. 562. By Mr. Westall: In illustrating by the dotted lines the construction of a device in substantially the manner and for the purpose of Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," it is not usual, is it, especially where there are a number of different parts which may make a great number of dotted lines confusing, to endeavor to represent all of the different features of construction, is it?

Mr. Blakeslee: Objected to as calling for a conclusion of draughting practice, and not the proper method of proof of the things purported or attempted to be shown by this blueprint which speaks for itself; not the proper method of proof, and merely argumentative.

A. The degree of completeness of parts indicated by dotted lines is usually personal to the draughtsman. In some practice, specifically Swedish and German, the objects depicted by dotted lines are as complete in their details as if they were shown in full lines. In American practice it is usual to abridge the representation to a certain extent. The dotted line indications of a complete device where it forms a portion of an equipment are usually to show its location on certain of the drawings with respect to the rest of the equipment, it being shielded by some object between it and the eye of the observer. For an understanding of the details of the device it is necessary to refer to specific drawings of the device. From the American point of view a few lines indicative of the location of the device is sometimes sufficient. Frequently, and in most cases, the draughtsmen go further than this and illustrate more of the details, in order

that it may quickly appear to the reader of the print what element of the total equipment is intended to be depicted by these dotted lines, and just how completely the details of the object are revealed, depends upon the personal view of the draughtsman.

XQ. 563. By Mr. Westall: Now, in selecting a butterfly valve for the by-pass valve of the patent in suit, and in rejecting a plug-cock valve, did you have in mind any advantage to be gained by the selection of a butterfly valve over that of the plug-cock valve?

A. No, for the reason that I never even remotely considered a plug-cock valve for the purpose.

XQ. 564. The merits and demerits of the butterfly valve and the plug-cock valve were well known, were they not, at the time of your alleged invention of the device of the patent in suit?

A. Both are well known in the art.

XQ. 565. You have intimated in your testimony, if you have not directly so stated, that the mechanism of "Defendant's Exhibit Berry Blueprint No. 1," sensitive to changes of speed of the water wheel directly operates the means moving the by-pass valve. Now, it is a fact, is it not, that this speed-sensitive mechanism does not of itself act directly on the levers which move ~~up~~ ^{the} water-wheel gates and by-pass valve, but that it only sets in motion by means of a line-to-line valve certain devices which act directly on the water gate and by-pass valve in substantially the same way that the dynamo of the patent in suit sets in motion devices and makes connections which permit the energy of the water wheels to be utilized in operating the by-pass valve and the water gates inversely to each other?

Mr. Blakeslee: We object to counsel attempting to re-testify for the witness, and particularly when he re-testifies without retestifying and therefore object to any metes and bounds and confirmation being placed arbitrarily on the previous testimony of the witness, which speaks for itself. If counsel wishes to recall to the witness this testimony, let him do so in *haec verba*. The question is further objected to on the ground that the question calls not for a statement of facts but for a conclusion as to the alleged operation and inter-relation and inter-operation of parts and features, and attempts to place an arbitrary construction upon the alleged modes of operation, and the like, entering into the performances of the structures referred to, and, therefore, that this is not the proper method of proof, and is merely argumentative and quasi academic.

A. I have never meant to intimate or in any way indicate that the motion of the parts of the device shown in Fig. 1 of the "Berry Blueprint No. 1" was communicated directly to the water-wheel gates and to the bypass valve. Such an inference would mean that there would be no governing mechanism or machinery interposed between this device and the valves other than mere links, or the means of transmission of this specific motion. It is possible that the idea is so definite that any governing mechanism must operate the gates of the water wheel by means of some source of power, which is supplied to the governor, and that the controlling means merely moves some small sensitive and easily moved portion of the governor to set in motion the more powerful devices of the governor mechanism it-

self, and in the proper direction, that I have probably frequently omitted to mention this fact.

XQ. 566. By Mr. Westall: As I understand your testimony, you have never taken up with the Abner Doble Company of San Francisco any question of alleged infringement of your patent, nor have you ever offered such patent to the Abner Doble Company at any time for sale. Is that correct?

A. I do not recall any direct communication from myself to the Abner Doble Company on this subject, although it is possible that I did communicate with it, and although, as I have stated, I do not remember ever having done so, I would judge that I had done so, because I left no opportunity or possibility of disposing of this patent untried. It is also possible that Mr. Messimer may have written to the Abner Doble Company, but this I do not know. It is always, however, assumed among engineers that every company manufacturing any articles or commodities of any character keep themselves fully informed as to the developments in the art which relate specifically to their own industries, and that in every manufacturing company a part of the important records is made up of copies of all available patents on these subjects. This, at least, is the practice of such corporations as I have been connected with or acted as adviser to.

XQ. 567. And would your answer be equally applicable if the name of William A. Doble is substituted for the Abner Doble Company of San Francisco?

A. So far as that portion of my answer refers to whether or not I communicated in person, is concerned, it would apply equally if there were a firm manufactur-

ing water wheels and water-wheel governors under that name and sufficiently well advertised either by paid advertisements in the technical journals or by the magnitude or quantity of their output for their existence to have come to my knowledge. I would also assume that the same statement I have made with respect to manufacturing companies keeping fully advised as to new inventions as disclosed by patents which might bear on the character of apparatus they were making, would also apply to any such firm if, indeed, any such firm were ever existent.

XQ. 568. When you mentioned the Doble Company as one of the companies you had heard were infringing upon your patent, did you mean the Abner Doble Company of San Francisco?

A. I believe it to have been the Abner Doble Company.

XQ. 569. And you never, so far as your present recollection is concerned, ever made any threats to begin suit against said Abner Doble Company of San Francisco?

A. I don't remember ever having made any threats to sue them, and I do not remember whether or not Mr. Messimer ever communicated with them on this subject. I ~~don't~~ know Mr. Messimer's communications on this subject. I have already testified that I paid very little attention to them.

XQ. 570. With regard to the amount of money which you might have been able to raise to bring suit on your patent against the various parties whom you at different times had knowledge or believed to have been infringers, am I correct in understanding that, act-

ing under the advice of counsel for complainant in this case, you decline to state whether you could have raised \$2,000 to institute suit against any of them for such alleged infringement?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, and as having been gone into fully and clearly by the witness previously further than could be deemed necessary or fair, in his answer to such question and it is not proper cross-examination and is a question delving, manifestly, into the personal affairs and personal credit and borrowing power of the witness, which is not to be inquired into, particularly after the witness has frankly answered as to his personal situation with respect to his expenditures.

A. I have already expressed myself and answered this question as far as it has appeared to me to be proper or appropriate. I, however, am willing to answer the question exactly as it stands, provided I am assured by counsel that this step-by-step method of first beginning at \$5,000 and ultimately reaching \$2,000 will not be carried on until an inferior limit of zero is finally reached.

Mr. Blakeslee: And we inform the witness that he need not answer the question at all unless compelled by the court, unless he receives such proper and courteous assurance from counsel.

Mr. Westall: And counsel declines to make any statement further as to his intentions in regard to the matter, and is willing that the matter of the propriety of the question should be submitted to the court at the time of the hearing, if the witness abides by the instruction of counsel.

Mr. Blakeslee: The witness is informed as to what his

rights are, that is, as far as counsel for complainant understands them, and he may do as he deems proper and expedient, unless the court compels him to take a certain course in the matter.

A. Since I am utterly unable in my mind to connect the inquiry with the subject of this suit, after having testified so definitely and fully as to my own decision that I was unable to prosecute a case, which decision might or might not have been justified but which was exercised with the best and most intimate knowledge that I had of the subject, I would prefer to await an order of the court before answering this question, not only for the reasons I have given and because it would seem to be an indication that by an admission of inability to raise \$2,000 were made that another step downward would result until my exact ability might finally be reached, regardless of whether this would bear on the ability to institute a patent suit or not. For this reason I prefer to await an order of the court to answer this particular question.

Mr. Blakeslee: As we understand the question, it is as to whether or not the witness had a certain amount of money which he might have spared to bring a suit under the patent in suit. As this cannot settle the question whether or not that would be sufficient money to carry the suit through, the question cannot be material, cannot instruct the court in any particular, and it is a waste of time to inquire into the personal affairs of the witness which is beyond complacent contemplation.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 571. Referring to "Defendant's Exhibit XX," and generally to the device designated as "J", do you, or do you not find what appears to you to be a stuffing box at the side of the structure, from which that part projects which apparently is intended to operate the internal feature, whether it be a valve, or what?

A. I cannot say absolutely, but I do not find any indication that would show a stuffing box.

RDQ. 572. Then what would the absence of such stuffing box indicate?

A. A fit between the plug and the surrounding casing.

RDQ. 573. For what reason?

A. Because there is no need of a stuffing box if the plug fits the surrounding casing, as, in order for any leakage to take place, the water would have to leak past those portions of the cylindrical surface which lie beyond the ends of the hole through the plug.

RDQ. 574. Inasmuch as you say you do not find any provision for a trunnion at the other side of this casing, what would that indicate in comparing this structure with the structure in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," at the place which counsel has marked "A" in red?

A. The side of the valve marked "A" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," differs from the structure shown in "Defendant's Exhibit XX" in that there is not only no indication in the latter which might even be considered as being possibly a trunnion,

but also there is no hub like projects from the central portion of the cover plate on this end, as depicted in the perspective picture "Defendant's Exhibit XX."

RDQ. 575. Therefore, what is your reasonable engineering conclusion as to what the element is contained within this case?

A. I can only conclude that the plug fitted with the surrounding casing as is usual with plug cocks.

RDQ. 576. And, therefore, if heavy water pressure comes to bear upon this plug, what will be the result of the frictional coefficient as regards governing action or action responsive to a governor, in turn responsive to changes in speed or load, or both?

A. Pressure acting on the valve will be proportional to the head of water acting on it, the diameter of the valve and its length, and the total pressure then set up will produce frictional resistance to motion, which would require a considerable force or effort to cause it to rotate.

RDQ. 577. If the rotating valve, assuming it is such, attempted to be disclosed in "Berry Blueprint No. 1" in Figs. 2 and 4, and heretofore referred to, does not have a tight fit in its casing, but there is an inter-space between it and the casing to permit water to pass around such valve, is it or is it not proper to call it a plug valve?

A. It would depend on whether or not it were otherwise supported. So long as the plug rests in contact with the surrounding casing, even though the fit be so badly made that it does not contact with the casing around a portion of its circumference, it still would, to my mind, be a plug valve.

RDQ. 578. In other words, you mean whenever there is friction between the valve and its seat or case, it would be designated as a plug valve?

A. Practically that. So long as the support of the plug is found in the casing which surrounds it, or a portion of the casing which surrounds it, it would still come in the classification of a plug valve.

RDQ. 579. Now, supposing such valve or device is mounted upon trunnions or in bearings or otherwise positioned so that there is an inter-space clear around it between it and its casing or seat, is it then proper to designate it as a plug valve?

A. I would not think so. My own idea of a plug valve is, as stated before, one which finds its support in its surrounding casing and in which it rotates.

RDQ. 580. If you were informed that this valve we have under discussion in connection with "Berry Blueprint No. 1" had been described by witnesses as a plug valve, what would you assume with respect to it having contact with its seat or casing?

A. I would assume that it had contact with the surrounding casing.

RDQ. 581. What would you assume with respect to its having any bearings or other positioning means upon which to rotate?

A. I would assume that these were not present if it were described as a plug valve, not only for the reasons I have given, but because the plug valve as it is known in engineering has no such positioning means.

RDQ. 582. Is it possible in any sense whatsoever to refer to a butterfly valve or a needle valve as a plug valve?

A. Not in the sense that is accepted in engineering practice.

RDQ. 583. Would a rotating valve on end trunnions clear itself of obstructions such as you have referred to in the nature of grass, twigs, or fine or relatively fine materials entrained in the water supplied to it or controlled by it, with the same facility that such clearance of obstructions would be made by a valve of the butterfly or the needle valve type?

A. Positively not.

RDQ. 584. And for what reason?

A. Because the plug is completely surrounded by the casing at the ends and over the portion of its length up to the edges of the openings through the casing. The space between the periphery of the plug and the inner wall of the casing would be necessarily comparatively small. There is never any change in distance apart of the periphery of the plug and the inner wall of the casing. Therefore, any foreign body which might enter by the operation of the valve as it rotates, and compressively rolled in between the plug and the casing, would not be able to get out nor could it be removed by the usual conditions of water pressure, because no matter how the valve might move, it would never increase the distance apart of the two portions between which the foreign body might be compressed. In the case of the butterfly valve or needle valve the moving member which has this relationship with the other portions of the surrounding body and moves a varying distance away from the different parts of the surrounding body, and therefore a foreign body which would be caught by either of these types of valves in one position would

be automatically released at some other position because the distance apart of the two elements of the valve between which the foreign body was compressed would be increased, allowing the body to free itself.

RDQ. 585. If you were called upon to specify a valve in accordance with the teachings of "Defendant's Exhibit XX" pertinent to the part "J" therein, and the teachings of Defendant's Exhibit Berry Blueprint No. 1" with respect to the parts "41", "42" and "43" in Fig. 4 thereof, and the further teachings of this blueprint with respect to the showing in Fig. 2 of this alleged valve device, what type of valve would you specify, and how would it fit its casing?

A. With these as the instructions before me, I would use the type that comes within the classification of plug valve, which I have previously described, and the plug would fit in the surrounding casing and be supported by it.

RDQ. 586. Referring to Defendant's Exhibit XX" do you find therein any fluid service pipe leading to what appears to be a hydraulic cylinder for operating the purported by-pass valve, and the water-gate valves, and also other service pipes for outflow from such hydraulic cylinder?

A. I cannot find any service pipe such as I understand you to refer to.

RDQ. 587. Would the apparatus be operative without such service pipes, assuming this is a hydraulic cylinder with a piston to move therein?

A. No; certainly not.

RDQ. 588. Do you find any connections shown in

this exhibit whereby such service pipes could be joined with the hydraulic cylinder and its valve case?

A. There is apparently an opening in the top of the valve case for one pipe. It would be impossible, of course, to operate with one service pipe.

RDQ. 589. Do you find any other openings for any other pipes on that device?

A. I do not find any other openings that are visible in this picture.

RDQ. 590. If this were a reproduction of a photograph of this apparatus, would it be a photograph of an operative apparatus with these pipes omitted?

A. No; unless there are openings which are somehow concealed.

RDQ. 591. Do you find, however, any openings or pipes corresponding in position to the openings for pipes in Fig. 2 of "Berry Blueprint No. 1," which lead to the valve casing and hydraulic cylinder or what is purported to be such assembly bearing the numerals "24,25" and "26"?

A. As I have testified that I can find no supply pipes whatever, and only one possible supply pipe opening visible in "Defendant's Exhibit XX", I certainly do not find anything to correspond with the supply pipes shown in Fig 2 of "Defendant's Exhibit Berry Blueprint No. 1."

RDQ. 592. Then is this a blueprint showing of these devices as shown in "Defendant's Exhibit XX"?

A. Not so far as this detail is concerned. If the blueprint is merely meant to be diagrammatic and indicative of the operation of the machine shown in "Defendant's Exhibit XX," and the machine shown in "Defendant's

Exhibit XX" may have some concealed openings not visible, it might be that there would be a correspondence between the two. But the location of any openings for service pipes not being shown in "Defendant's Exhibit XX," the side of the valve chamber being smooth as far around its outer circumference as can be seen, and while in the blueprint three service pipe openings are shown as connected into the valve chamber on the side and directly at one end of the horizontal diameter, it is clear that the blueprint does not exactly represent the devices shown in "Defendant's Exhibit XX."

RDQ. 593. With respect to what we have discussed as purporting to be a by-pass valve and case in "Defendant's Exhibit XX," and also in "Defendant's Exhibit Berry Blueprint No. 1," Fig. 2, and in view of the fact that you find no trunnion showing in the former exhibit, is "Defendant's Exhibit Berry Blueprint No. 1" a correct showing of what is portrayed in this other exhibit?

A. It is not; but the reason does not relate so specifically to the absence of the trunnion, which I am not convinced is shown in the Berry Blueprint; it relates specifically to the hub-like boss at the center of the left-hand valve cover as shown in "Berry Blueprint No. 1," while in the picture shown in "Defendant's Exhibit XX" there is no such boss shown.

RDQ. 594. So there is no boss or trunnion or protuberance shown in "Defendant's Exhibit XX?"

A. That is correct.

RDQ. 595. As a skilled engineer do you have as a rule any difficulties in quickly grasping the proper ordinary showing of a blueprint or drawing such as "De-

fendant's Exhibit Berry Blueprint No. 1," in order to get a concept of the same upon which you can predicate hypotheses as to operation?

A. Not usually. This is a matter, however, that is largely dependent on the draughtsman, and a drawing of the same apparatus made by one draughtsman would be very much more clearly depicted and easier to understand, and, therefore, quicker to read, than a drawing of the same ^{apparatus} ~~apparatus~~ made by ^{some other} ~~one draughtsman~~ would draughtsman.

RDQ. 596. Have you ever had the opportunity to observe the operation of hydro-electric plants upon a synchronous system, and the methods of governing such plants?

A. Yes; if by your question I understand it to refer to circuits supplied by alternating generators, and which feed synchronous motors, rotary converters and like synchronous apparatus.

RDQ. 597. How is it customary to govern such systems with respect to several contributory plants or central stations?

A. In case of plants driven by water wheels, it is usual to have each unit controlled by an independent governor responsive to changes in speed of the unit, due to change in load.

RDQ. 598. Suppose these plants are driven or operated by sources of water supply which vary, so that at one time one plant may have an over plus of water and another plant an under amount, and, vice versa, at which of these plants upon such synchronous system, if any, is governing more practicable?

A. It depends somewhat upon the design of the plants. It is better always to have the maximum possible load taken by those units which are connected with water wheels that have the largest supply of water, and as small a proportion of the load as possible on those plants in which there is a shortage of water.

RDQ. 599. Do I understand by that that it has been your observation that sometimes governing is done for the system at one plant and sometimes at another?

A. In certain types of plants that I know of the governing may be principally done by one of the plants, the others giving all of the power that they are able to give and running continuously at maximum output.

RDQ. 600. Do you know whether Mr. Messimer, the patent attorney referred to, ever wrote to the Pelton Water Wheel Company of San Francisco that it had infringed the patent in suit?

A. I do not, but I believe him to have done so.

RDQ. 601. And this would be in addition to the personal notice which you gave the Pelton Water Wheel Company, or the two notices which you have testified about?

A. If any such communication had ever been sent it would be additional to these.

RDQ. 602. Now, referring to "Complainant's Exhibit A," the patent in suit, will you please state in what manner the rope actuating the by-pass valve is applied to the sheave wheel "54", as shown in Figs. 1 and 5?

A. The rope was meant to pass around a drum or sheave wheel, and in the preferred construction the ends of the rope passed into the periphery of the wheel and

were knotted inside of the periphery so that the rope would be constrained to move with motion of the wheel.

RDQ. 603. Now, in order to shift the by-pass valve from one position to another in the by-pass pipe without rotating the sheave wheel "54" and, therefore, to set the by-pass valve at a different angle, or, call it the normal position, what would you do with respect to this rope and sheave wheel?

A. Simply lengthen out one and draw in the other of the ropes shown in the drawing Figs. 3 and 4, or if the construction were a rope passing around the sheave wheel and depending for its motion on the grip within the sheave wheel, the ropes could be slackened and the adjustment made and the tension again applied to the ropes. There are several methods that might be employed. Those two would probably be the most obvious.

RDQ. 604. And if the sheave wheel were then not turned during this readjustment of the rope the pin "73" upon the sheave wheel would still maintain its normal position with relation to the circuit breaker "74" which is designed to open the circuit through electro-magnet "64"? Is that correct?

A. Yes.

RDQ. 605. And, therefore, with the by-pass valve in its new or changed normal position, the actuating parts and other parts controlling the by-pass, their energization and operation, would not be affected as among themselves as to position or otherwise in any respect, would they, and would serve to actuate and control the by-pass valve in its new normal position the same as previous to such adjustment? Is that, or not, correct?

A. That is correct.

RDQ. 606. I notice in Fig 5 what appears to be some mode of connection of the turnbuckle device with the rope or cable "51" or "52", as the case may be. What will that connection permit as to the turnbuckle?

A. The connection indicated there is a sleeve through which the rope passes, and held in position by a clamp held by a set-screw. I do not understand what is meant by the question "What will this connection permit?"

RDQ. 607. What is the relation between this clamp and the turnbuckle?

A. The clamp is at the end of the turnbuckle. It is a portion of the stud of the turnbuckle which is threaded.

RDQ. 608. And is that stud capable of adjustment with respect to the other portions of the turnbuckle?

A. Certainly. By turning the turnbuckle it changes the position of the stud.

RDQ. 609. And how with respect to the normal position of the stud with respect to other portions of the turnbuckle? Can in any way the play of the central member of the turnbuckle upon or in connection with this threaded portion be varied?

Mr. Westall: Objected to as leading and an attempt to coach the witness.

A. If by that I understand that the stud can be screwed in and out of the turnbuckle so that the distance from one rope connection at one end of the turnbuckle to the other rope connection at the other end of the turnbuckle is changed, this is unquestionably true as it is the function of the turnbuckle to perform just such service,

whether joining together ends of ropes, iron bars or other connecting members.

RDQ. 610. By Mr. Blakeslee : Now, then, put it this way: Is it possible by means of this clamp to lengthen or shorten the reach of rope between it and the cross-lever "50" that carries the stem of the by-pass valve so as to affect the normal position of the by-pass valve subject to further regulation by means of the turnbuckle?

A. Yes. Certainly. That could easily be done. Also, the stem of the by-pass valve could be loosened by loosening the set-screw in the lever, and the valve rotated to any changed position it desired. There are, of course, obvious and numerous methods by which this change in the normal position of a valve can be accomplished.

RDQ. 611. Then taking these disclosures which we have enumerated as to flexibility and adjustability pertinent to and within the train of parts serving to control and actuate the by-pass valve, could you, as an engineer, design from such disclosures a by-pass and its control, fully equipped with respect to adjustability to permit variation of the normal position of the by-pass valve so as to set it at any point between fully closed and half open?

A. It seems to me that any engineer could make ample and sufficient designs from these disclosures. Of course, it is to be understood that my state of mind could not be other than that this would be a full and ample guide to any person skilled in the art.

Mr. Westall: We move that the latter part of the answer referring to the "state of mind" of the witness be stricken out as not responsive to the question.

RDQ. 612. By Mr. Blakeslee: If you were instructed in accordance with the teachings of the patent in suit to design the water-wheel governor, in which means were provided for operating water gate in either direction, and you were instructed also to design a by-pass valve for the water wheel, so inter-related with the means for operating the water gate,—this in either direction—that the by-pass valve would be capable of performing a movement inverse to that of the water gate, within what limits of control of the by-pass valve and relation of it in the movement to that of the water gate would you lay out your designs?

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A. It would depend. If I were making a design for a water-wheel governor for some specific plant in which all the known conditions were before me, I would design a governor and a by-pass valve and the operation of the latter to accord with these conditions. If the length of penstock were very great, I would make a by-pass valve larger than if the penstock were short. If the inclination of the penstock were comparatively slight and ample water were available, I would design the valve to stand normally in its half-open and half-closed position, and be operated inversely to the main gate when the main gate was moved either to its closed or to its open position. If the conditions existed of rapid slope of penstock, or a vertical penstock were present, I would design the main by-pass gate so that it would stand normally in its closed position and operate inversely to the main gate only when the main gate tended to close. Obviously, the relative arrangement of parts and their

relative sizes would depend on the local conditions. If I were manufacturing water-wheel governors in quantities to be shipped to various parts of the world and installed at the various localities to which they were sent, and without a specific design for each specific condition, I would make the by-pass gate to operate inversely to the main gate whether the main gate moved to close or to open, and I would arrange so that the normal position of the by-pass valve could be half-open and half-closed with, of course, the ordinary adjusting means such as have before been pointed out for changing this normal position to some other normal position such as fully closed, and adjusted to operate inversely to the main gate only when the movement of the main gate was to close, so that the erectors of the apparatus at any point could adjust the mechanism to suit whatever specific condition would be encountered. In other words, a universal mechanism would require that the by-pass valve could have its normal position adjusted to any point between fully open and fully closed, that might appear desirable and necessary for the specific conditions under which the apparatus would work.

RDQ. 613. And with the water-wheel gate, of course, mounted so that it could move in either direction to correct or alter the water-wheel speed, would or would not your invention as conceived, develop and disclosed to your patent attorneys for the purpose of applietiaion by you for a patent be satisfied and utilized if the by-pass valve were disposed normally in such position that it could accompany movement of the water-wheel gate in an inverse relation and so accompany the water-wheel

gate in only one direction of its direction of movement.

Mr. Westall: Objected to as incompetent, irrelevant and immaterial, and on the ground that the conception or intention or disclosure by the witness to any patent attorneys is not the subject of suit, nor in any way involved in this proceeding except in so far as it may have been covered by the claims in suit.

A. I consider that the construction shown and claimed in the patent covers the movement of the by-pass valve inversely to the main gate, even if it accompanies the movement of the main gate in one direction only and not in the other; and I did discuss this factor or possible condition with the patent attorneys who prepared the patent specification and claims. It, however, is impossible to arrange the by-pass valve in practice such that at some time in its operation it will not move inversely to the main gate in either of the directions of motion of the main gate, even if its normal position be set at the closed position. This can possibly be explained by the assumption of a sudden diminution in load accompanied by a closing of the water-wheel gates, and a corresponding opening of the by-pass valve, which by-pass valve has started from its normal position of being fully closed. By the conditions of the patent the by-pass valve slowly returns to its normal position, while one of the objects to be achieved is that the water-wheel gates shall be moved quickly to their new positions corresponding to the change in load and actuated by the change in speed. Subsequent to movement of the water-wheel gates to the new position of diminished gate opening, and while the by-pass valve is still in its opened po-

sition and starting to return automatically to its normal position of fully closed, if a sudden increase of load be demanded of the water wheels the water-wheel gates will move quickly to a more open position and will cause the movement of the by-pass valve from its then open position to a closed position, which movement will be rapid and in accordance with the movement of the water-wheel gates and not slowly as though the valve were returning automatically to its normal position independent of the action of the water-wheel-gate shaft. And for these reasons I do not consider that under all conditions of load, it would be possible to prevent the by-pass valve from being moved in a direction inverse to the direction of motion of the water-wheel gates, no matter in which direction the water-wheel gates might move, and even if the by-pass valve be adjusted so that its normal position would be completely closed.

RDQ. 614. By Mr. Blakeslee: And this movement of the by-pass valve in a closing direction during this secondary governing, or sub-governing action, would be a positive movement independent of its returning tendency, would it, or would it not?

A. It would be a positive movement independent of its returning tendency.

RDQ. 615. How often in ordinary governing of an ordinary hydro-electric plant is it safe to say, from your experience and observation, that such a combination or merging of governing actions producing such by-pass activities occurs in a day's run of the plant, including both peak and valley loads on the plant?

A. That would depend entirely on the relation of the

fluctuating load to the total capacity of the plant. It in most cases could not be expected except at very rare intervals. But in the case of a very small plant supplying energy to a motor, the size of which was large as compared with the capacity of the plant, and which motor would drive a rapidly fluctuating load, such a rapid succession of load changes as I have described might occur at fairly frequent intervals.

RDQ. 616. In a governor organized such as that disclosed in "Complainant's Exhibit A," the patent in suit, or any governor containing or ^{incorporating} employing the principles of operation and co-action of parts and features disclosed in the patent in suit, is it or is it not possible for any governing effect to be produced upon the water-wheel gate without an impulse being imparted to the by-pass valve, irrespective of its normal or then position, tending to move it in one direction or the other?

A. It is possible and, in fact, contemplated that the water-wheel gates may be moved at times without imparting an impulse to the by-pass valve when the conditions under which the governor is installed make it desirable to so adjust the mechanism.

RDQ. 617. Very well. Then let us assume the same conditions as last mentioned and add the following conditions, namely, that just previously to such impulse being imparted to the water-wheel gates the by-pass valve is connected up with the governor so as to be subject to governing action. Under these conditions is it or is it not possible for any governing action to affect the water-wheel gates without a governing action impulse being imparted to the by-pass valve, in whatever position it

may be, tending to move it in one direction or the other? If you can answer this question by yes or no, please do so. If not, you may make such answer as you best can.

A. The question is not sufficiently clear to me for me to be able to answer yes or no. With the by-pass valve forming a portion of the mechanism as disclosed in this patent and arranged to be operatively connected with the governor, the governor will operate it and move it in either direction whenever operation of the governor takes place and the valve is not in one of its extreme positions of the direction of motion in that direction which would tend to move the valve past this extreme position.

RDQ. 618. And even if the by-pass valve is in such extreme position, we will say either in entirely closed or in entirely open position, and is so connected up with the governor mechanism as to be responsive to governing action, will or will not an impulse urging the by-pass valve to move be imparted to it simultaneously with the passing of the impulse to the water gates to move?

A. If the direction of motion be to open the by-pass valve, it will move; if the direction of motion be to attempt to still further close the by-pass valve, it will not. There may be, of course, an initial effort of the governor to move the valve past its fully closed position, but the prevention of continuance of such effort is disclosed in the patent and need not here be described.

RDQ. 619. But, nevertheless, is it true or is it not true that with the by-pass valve tied in with the governor or hooked up or connected with it operatively, an impulse will be imparted to it urging it to move, whether it can or cannot, in a direction inverse to that of the

water-wheel gate whenever an impulse is imparted to the water-wheel gate?

Mr. Westall: Objected to as having been already fully answered by the witness as far as the witness is able and being merely a duplication of previous questions, needlessly expanding the record.

A. If the gate be fully closed and it be connected operatively with the water-wheel governor and the movement be in such a direction as would tend to urge the gate still further in the direction of closure, there will be a force of pressure tending to move it past the closed position, which pressure will continue until the means of relieving such pressure as disclosed in the patent, have operated.

RDQ. 620. By Mr. Blakeslee: But my question was not with respect to the gate, but the by-pass valve. You have used the term "gate" in your answer.

A. I have in every case meant by-pass valve in the same sense that I have hitherto used it in this testimony.

RDQ. 621. Is it or is it not optionally responsive to the particular determination or selection with respect to the conditions to be dealt with in governing, how far the by-pass valve shall move with and inversely to the water-wheel gate before the by-pass valve comes to its seat, or whether the by-pass valve moves with the water-wheel gate at all inversely thereto in one direction of gate movement?

Mr. Westall: Objected to as leading and suggestive.

A. The functions which you mention are optional so far as the actual movement of the water of the by-pass valve is concerned. As I have previously stated, how-

ever, if the by-pass valve has reached its extreme limit of motion in either direction, and there be a further tendency of the water-gate mechanism to constrain it to move further in this same direction, there will be a force set up tending to move it, but, by the conditions of ordinary design, it cannot be further moved.

RDQ. 622. By Mr. Blakeslee: Is there or is there not in your mind any doubt as to the operativeness of the entire governor apparatus disclosed in "Complainant's Exhibit A," the patent in suit?

Mr. Westall: Objected to as calling for a conclusion on the part of the witness and not for facts upon which a conclusion might properly be based, and as not relating to any specific construction.

A. There is no doubt in my mind but that the construction in strict accord with the disclosure of the patent in suit would be an operative speed-controlling device for water wheels.

RDQ. 623. By Mr. Blakeslee: Is there or is there not in your mind any doubt as to whether such apparatus would constitute a feasible, practicable, serviceable and reliable working device?

Mr. Westall: The same objection.

A. Assuming proper machine design, selection of materials and adjustment, it would possess all these characteristics.

RDQ. 624. By Mr. Blakeslee: You have testified that to make one such governor apparatus would cost approximately \$1600, and that they might be duplicated in manufacture in lots at approximately \$300 apiece. Are you able to tell us what the market price today of the

Lombard governor, such as we have discussed in your testimony, manufactured by the Lombard Governor Company, of Ashland, Massachusetts, is, with the same working capacity as that which you testified about at the manufacture cost of \$300?

A. Approximately from \$600 to \$800 each. I do not mean by this that these sums represent the cost to the Lombard Governor Company, but they represent approximately the market prices at which the governors are sold.

RDQ. 625. As an engineer, if you could find such a manufactured Lyndon water-wheel governor in stock, and purchase price was no consideration, which governor, that Lyndon governor or the Lombard governor, would you select or specify to be installed in a hydro-electric plant the erection of which you were in charge of or responsible for?

A. I would select the electro-mechanical or Lyndon governor provided it were on the market, manufactured by a company of whose continuance of existence I could be assured, so that any time repair parts might be available. I may say here that this matter of ability to obtain repair parts is one of the most important considerations in the selection of any engineering apparatus.

RDQ. 626. And would apply equally in any decision to select and install a Lombard governor?

A. It would apply equally in regard to the Lombard governor or any other governor.

RDQ. 627. You have referred in your testimony to the partially completed Lyndon governor manufactured at Kutztown, and have spoken of it as an experimental

governor. In what respects did you wish us to understand that the contemplated completion of this Lyndon governor was experimental in nature?

A. Only in relative dimensions of mechanical parts. For instance, without a trial, we could not be sure that the electro-magnets would exert a sufficiently great pull to insure engagement of clutches under all conditions, or, on the other hand, we might find that the strength of the pull of the magnets was so great that there had been a waste of material, copper, iron and labor, in making these magnets so large, and that they might reasonably be reduced in size and still give just as satisfactory governing. We might find that the size of the mercury cups instead of being as large as designed could be diminished, thereby decreasing the quantity of mercury necessary. By "experimental," therefore, I mean that from this governor and its operation we could determine the most economical commercial device to be subsequently manufactured and fulfill the conditions as set forth in the patent specification. I did not mean to convey the idea that this governor would be experimental in the sense that I intended to use it in hunting out any new features of water-wheel governing.

RDQ. 628. In adjusting the contact devices of "Complainant's Exhibit A," the patent in suit, namely those which control the energization of the electro-magnets "15" and "16", those which control the energization of electro-magnet "32", and those which control the energization of the electro-magnet "64" the first group of magnets controlling the clutch-gear mechanism, the second magnet controlling the returning device, and the

third magnet controlling the by-pass device, as, for instance, by varying the depth of the mercury in the mercury cups comprising such contact devices, as more particularly disclosed in Fig. 5 of the patent in suit, please state briefly the reasons, based upon more particularly causing the governor mechanism to respond and varying conditions of governor service, which would actuate you to so adjust these contact devices as to vary the sequence of energization of the respective electro-magnets?

A. The depth of mercury or the length of the contact points on the main lever "26", that is to say, the contact "40, 40a", "41, 41a" would be adjusted so that contact could be made to energize one or the other of the main magnets with approximately the same angle or displacement of the lever "26" from its normal horizontal position. Referring to blueprint "Complainant's Exhibit BB" which is here used because it so clearly shows the conditions and assist in the explanation, it is apparent that the contacts "41, 41a" have closed, energization of one of the main magnets has taken place, motion of the water-wheel governor has begun, and all of this has happened before any of the contacts on lever "43", which contacts close the circuit through the magnet actuating the returning device and that one actuating the by-pass valve, have been energized. Therefore, for this particular position of the contacts the governor is moving and moving without either the returning device or the by-pass valve having started motion. This is the condition which exists with a proper setting of the contact points when motion of the speed-control device

first begins. That is, this is one of the transition points in the movement. As the levers keep moving, the next contacts which are closed are those which pass current to the magnet "32" which actuates the returning device. That is to say, by the time the speed-control mechanism has reached this point in displacement, the returning device begins to act. Further displacement of the parts then closes the remaining contacts, which sends current through the magnet "64" actuating the by-pass valve as has before been described. It is obvious that for a comparatively small speed change, and, therefore, a comparatively small movement of the controlling mechanism, that the by-pass valve may not be moved. This would occur for practically infinitesimal speed changes which would be, possibly, subsequent to governor action. On the return of the controlling mechanism to its normal position, the order of opening the contacts would be inverse to that of closing them, namely, the contacts first opened would be those which energize the magnet operating the by-pass valve, the next would be those operating the speed-returning device, and the last magnets opened would be those energizing the main clutch of the governor.

Mr. Blakeslee: That is all.

RECROSS EXAMINATION.

By Mr. Westall:

RXQ. 629. You have stated in answer to a question concerning the device of the Lyndon patent in suit, that assuming proper adjustment, the device would be a practical working device. I wish to ask you whether this

assumption of adjustment included an adjusting means by which the by-pass valve could be placed in normal closed position instead of normal half-open position?

Mr. Blakeslee: Objected to in so far as it does not correctly summarize the testimony referred to, and as calling for a conclusion upon the very statement of the question, and not the proper method of proof.

A. I had not this particular adjustment in mind, for the reason that the machine would be operable whether the by-pass valve were adjusted in the position of half-open and half-closed or in the fully closed position. What I had in mind was with reference to the proper machining of the gears, that the relation of the air-gap of the magnets be properly adjusted so that the magnetic pull might be fully exercised, and that the adjustment at the end of the lever "14" might be such that when one end thereof was pulled close up to one of the actuating magnets the clutch on the other end would have been thrown into operative position. Also, the same statement applies to the idea that the distance of separation of the end of the magnet "32" from the cooperating end of the lever "31" should be such that when the end "31" has moved to its extreme position toward the end of the magnet, it would at the same time have brought the two discs "22" and "23" of the returning device into frictional contact. Furthermore, that by adjustment of the nuts "36b,36b" thereby adjusting the tension of the springs "37,38" that the solenoid core "34" would be properly balanced. I meant adjustments of this kind. The parts of any machine might be thoroughly well made and assembled, but without adjusting the relation of

these parts properly no machine will be a satisfactory operating device.

RXQ. 630. By Mr. Westall: And you also meant to include within such proper adjustment the height of the mercury in the cups, as illustrated in "Complainant's Exhibits AA, BB and CC," which are not disclosed or shown or hinted at in the patent in suit, did you not?

Mr. Blakeslee: Objected to as placing an apparently improper construction upon the patent in suit, in which these mercury cups have been found by the witness several times and discussed by him.

A. I, of course, contemplated a proper adjustment of the contacts so that on movement of the controlling mechanism the contacts would be made at proper points and proper times with reference to the movement of the lever.

RXQ. 631. By Mr. Westall: Have you any means of knowing or do you know the manufacturing cost of the Lombard Governor to which you have referred on your redirect examination?

A. I have no means of knowing what the Lombard Governor Company's cost for manufacturing, including their overhead charges, are.

RXQ. 632. From your general engineering experience and from your knowledge and long study of the device of the patent in suit, could you in any way compare the cost of manufacture of the device of the patent in suit with the cost of manufacture of the Lombard governor? That is, assuming, of course, a plant should be installed and equipped with such completeness and with such capital as the Lombard Governor Company's plant

for the manufacturing of the device of the Lyndon patent in suit?

A. I have not made any such comparison that I recall that is of definite character. The construction of the Lombard governor being such that it has always appeared to me as obvious that it would cost more to manufacture than the governor disclosed by the patent in suit, assuming the conditions surrounding both which you mention, I could make a fairly close estimate of the actual cost of the Lombard governor, but this would, of course require going over the details and estimating the cost of each separate portion, and taking these together and to this adding the cost of assembling and such additional shop charges as testing, packing and preparation for shipment. But, as I have not done this within recent years, and I do not now remember about any previous estimates of this kind of a definite character, I could not give you a comparison that would be of any value. I judge, however, that the so-called Lyndon governors could be made at a cost of not exceeding from 60 to 65 per cent of the cost of a corresponding Lombard governor, this referring, of course, to shop costs only, for labor and material, and exclusive of overhead charges. Furthermore, my estimate of about \$300 to \$325 as the cost of a Lyndon governor, was an outside figure and did not contemplate as favorable conditions of manufacture as you mention, and also included it in some of the ancillary charges.

RXQ. 633. Including all of the shop costs and roughly approximating or estimating the relative cost of the two devices, would you be willing to say that the Lyndon

device could be made at 60 or 65 per cent to be placed on the market and sold at a profit of 60 or 65 per cent of the cost of the Lombard governor?

A. These also would depend on the quantities of any specific size which might be made. But, taking as an example a 5000 foot-pound governor, I believe that the shop cost of the Lyndon governor would not exceed \$195 or possibly \$200, and that the shop cost of the Lombard governor of the same capacity would run somewhere between \$275 and \$300.

Mr. Westall: That is all.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 634. Is it possible to set up and make ready for use and operation any other water-wheel governor, or any other hydro-electric apparatus with which you are acquainted, without first adjusting or tuning up parts so that they shall be in their best condition and most harmonious relation for service?

A. No.

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GEORGE J. HENRY, JR., complainant herein, being recalled on his own behalf, the direct examination is resumed.

By Mr. Blakeslee:

RDQ. 532. What does the presence of the indicator device at the Power Development Company plant, or Power, Transit & Light Company plant you have pre-

viously referred to, and the observation of the same in connection with the handling of that plant, indicate?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial, not proper rebuttal. The condition of the plant, or any of its equipment at the present time, approximately seventeen or eighteen years after the time that the device set up as a defense in the answer was installed, cannot possibly in any manner affect any of the issues within the present proceeding.

Mr. Blakeslee: Without argument, we will merely reply that we are attempting to show the conditions not only existent at that plant at the present time, but likewise existent at the period of its attempted operation, of the alleged anticipatory nature. Furthermore, we are attempting to show the failure of that plant to do and continue to do what it has been attempted to be proved it was designed and installed to do.

A. It indicates the variation in the depth of water in the forebay, and, therefore, the head of water operating against the wheels. The indicator device is mounted at the box or tank called in the art "the forebay," from which the pipe receives its water, and the position of the surface of this water determines the actual head operating against the wheels. The head of this surface is indicated by a float and a weight of the usual type, and is observed through a telescope from the power house. Such observations are made frequently by the operator in charge to enable him to intelligently make the necessary adjustments of the hand-controlling devices to use most effectively the water under its varying head. This

variation in head is one of the variables to be met with in power house operation.

RDQ. 533. By Mr. Blakeslee: Is such variable head a factor usually met with and to be dealt with in power house practice?

A. Very frequently is it met with.

RDQ. 534. From your knowledge of power supplying stream conditions, particularly in California, can you state with certainty as to whether any given stream, the energy of which is used for hydro-electric power generation, maintains its general flow conditions and changing head conditions perennially unless these are altered in some artificial manner?

A. No; nearly all streams vary greater or less amounts during different months of the year, during different days of the month, and during different hours of the day.

RDQ. 535. And is that true of any given stream year after year, so that the general average of fluctuation of flow for a given year is substantially the same as for a previous or subsequent year?

A. Over a long period of time it will average about the same.

RDQ. 536. What causes these fluctuations?

A. Fluctuations are occasioned by numerous causes. For example, a stream that is fed from snow fields close to the point where the measurements are made, will flow very much more on a bright sunny day. A stream that flows through a long water-shed, denuded of vegetation, will have its heaviest flow immediately following a rain storm; hot sunny days will tend to slightly reduce its

flow. There are so many factors that enter into the determination of the final flow passing any given point in a stream, that it is difficult to give any brief account of the degree of these effects. I might say that the degree of variation from normal flow is many hundred per cent in some streams, and comparatively few per cent in others. There are, however, in all streams frequent variations which make it advisable where the greatest economy is to be accomplished by the hydraulic station that these variations be taken into account not only in the original design and application of the apparatus, but in its operation as well.

RDQ. 537. And for those reasons, and particularly dealing with the conditions pertinent to the head variation indication at the Power, Transit & Light Company plant, can it be stated with reasonable certainty as to the occurrences of these variations in head at that plant at the time there was attempted to be operated the purported water-wheel governor, including the speed and load-sensitive device installed with the Girard water wheels?

A. There could never have been a time within the memory of man when there would not have been fluctuations in the flow of the Kern River. Such fluctuations would reflect in the depth of the water flowing in the flume, tunnel or canal supplying the pipe line to this power plant, even though only a fraction of the water of the river were in use by that plant. The point of intake of the pipe line is something that was fixed by the slope of the flume as indicated in the upper right-hand corner of "Complainant's Exhibit Power Development Company's plant," and regardless of any flume changes

that might be made, or of the substitution of a flume for a tunnel, there would still be reflected at the intake of the pipe line the changes in water level which would occasion the changes in head on the water wheels. These changes would occur even though regulation were also affected at the intake of the flume, as it probably is and was. The artificial changes in the water flow in the flume or tunnel at its intake and at the opposite end from the forebay and pipe intake, would also occasion these changes in head, and there is no doubt in my mind but that this plant must have had such changes at the time of its original installation, as did and as do most other power plants of a similar nature.

RDQ. 538. Referring now to "Defendant's Exhibit Berry Blueprint No. 1", "Defendant's Exhibit XX," and "Defendant's Exhibit MZ," and "Defendant's Exhibit Cobb Blueprint No. 1," have you examined these exhibits and familiarized yourself with their disclosures and come to any conclusions as to the intended construction and mode of operation of the device disclosed in them?

A. I have.

RDQ. 539. I call your particular attention to the parts in "Defendant's Exhibit Berry Blueprint No. 1" shown in detail in Fig. 1, and to the parts and features shown in "Defendant's Exhibit MZ," and ask you to state briefly what you understand to be the intended construction and mode of operation reflected by these exhibits?

A. These exhibits to which you have directed my attention indicate a dynamometer for measuring the load

between two rotating shafts, and the degree of movement of the weighted levers within the fly-wheel when properly adjusted indicate the amount of load being transmitted from one shaft to the other.

RDQ. 540. With what part or parts of the hydro-electric installation do you understand the annulus or wheel "M" and the yoke or diamond shaped piece "B" of "Defendant's Exhibit MZ" are respectively connected?

A. The fly-wheel "M" carrying the pivots "H", "H' ", I understand from "Berry Blueprint No. 1" to be mounted upon the shaft driven by the water wheels, and from "Defendant's Exhibit Interior of Power Development Company Plant," I understand this shaft to be the generator shaft. The link "B" in "Exhibit MZ" I understand to be mounted upon the water-wheel shaft. This is the driving shaft, and the link "B" therefore pulls the link "~~BB~~-B' " around, dragging after them the wheel "M" in the direction of the arrow on "Exhibit MZ."

RDQ. 541. Through what agencies is the wheel "M" so dragged around by the water-wheel shaft?

A. Through the links "DD' " and the levers "EE", connected with the wheel "M" at the point "HH' "

RDQ. 542. And these levers are pivoted into the annulus?

A. They are.

RDQ. 543. And, therefore, capable of moving in the annulus, and, if that is the case, what takes place during the rotation of the annulus and the production of centrifugal action in the levers?

A. When the device is rotated from the water-wheel shaft at sufficient speed, depending upon the adjustment of the weights "F", "F' ", and the springs "SS' ", and the load being transmitted from the wheel to the generator, they will move under the action of centrifugal force, causing a torsion or displacement between the generator shaft and the water-wheel shaft. The position of these levers will then be varied upon a change of load transmitted between the two shafts, regardless of the cause of such change of load. The device is itself a load-measuring or load-indicating device.

RDQ. 544. How is such measurement or indication rendered appreciable?

A. By the relative torsional displacement between the shaft carrying link "B" and the shaft carrying the wheel "M".

RDQ. 545. And that produces what visible effect with respect to the levers?

A. That causes a variation in the position of the levers "EE" with respect to their distance from the center of the shaft.

RDQ. 546. And this advertises the change of load. Is that correct?

A. Yes.

RDQ. 547. And what constrains the levers so that they respond in change of position to this variation of load?

A. As I have before stated, the indication of change of load will, of course, only occur when the device is properly adjusted. Such adjustment depends on the

weights "FF1", springs "SS1", the load being carried, and the rotative speed of the parts.

RDQ. 548. As the annulus "M" moves, will the levers maintain the same positions with differences of speed of rotation of such annulus, or what will be the effect?

A. They may or may not, but they will be disturbed from their positions upon a change of load. All my testimony in regard to this device is based upon the mechanism being properly adjusted with respect to the moments entering into the determination of the loads being carried between the two shafts.

RDQ. 549. What movement will an increase of load tend to produce in the levers?

A. If a greater load comes upon the electric generator this demands of the water-wheels that they supply the additional energy. The result is that a drag is put upon the wheel "M" in the direction opposite to the arrow on "Defendant's Exhibit MZ." Such a drag or retardation will result in drawing inward the levers "EE1". It must be noted that in this exhibit these levers are shown against their stops. The normal position of the lever "E" will be at a point substantially midway between the position shown in full line and the position "F1", but it will be drawn in on the increase of load on the generator toward the full line position "E".

RDQ. 550. What will maintain the lever in this stated normal position?

A. A constant transmission of energy or load from the water-wheel shaft to the generator shaft will maintain it in a fixed position, which fixed position will be proportional to the actual energy transmitted or degree

of load. Upon an increase of load the levers will move inward. Upon a decrease of load it will move outward, in the former case increasing the tortional displacement between the water-wheel and generator shafts, and in the latter case decreasing it.

RDQ. 551. And this position of the levers outward from their stops during joint rotation of the water-wheel shaft and the generator shaft takes into consideration, does it, also, the centrifugal force tending to throw these levers outwardly towards the dotted position you have mentioned?

A. It does. The position occupied by these levers, as I have before stated, is dependent upon the load. The load is counterbalanced by the speed, centrifugal force acting upon the weights and levers, and the springs. As the device rotates faster the centrifugal force acting is greater. As it rotates slower the centrifugal force acting is less. The result of the action will be that if the load on the generator, and, therefore, on the dragging effect of this load on the wheel "M" be increased, the weights and levers "EE1" will move inward towards the shaft toward their full line position in "Exhibit MZ" to some new position, and the result will be fall of speed or a retardation in the rate of movement of the shafts. And this new position will be a position of equilibrium of the rotating weights, levers and springs at the new load.

RDQ. 552. Then as I understand you, the speed factor tends to throw these levers outwardly and the load factor tends to the opposite movement, or to move them toward their seats. Is that correct?

A. Yes.

RDQ. 553. Now, with these two forces acting upon these levers and the levers off their seats, the power of the water wheel is being transmitted to the generator through these removable unfixed lever elements. Is that correct?

A. Yes.

RDQ. 554. Now, with the levers in such instance or, as you term them, normal positions, with the power of the water-wheel shaft being transmitted to the generator shaft through these unfixed levers, assume that an increase in load occurs on the generator and an increase of head occurs in the pipe line supplying the water wheel. What will be the result with respect to the then positions of said levers, and why?

A. If this came about slowly, as it probably would in practice, due to an increasing depth of water in the forebay, as previously testified to, the levers would undoubtedly remain fixed in their position and neither apparatus would increase in speed, causing an over-voltage on the circuit; and if this were of a sufficient degree it would cause, probably, the burning out of incandescent lights and fuses.

RDQ. 555. And would such action of this device under discussion be or have been possible at the Power Development Company plant, with the changes in head there occurring, judged from the use of an indicator device at the forebay?

A. Such conditions would be inevitable with this device if used at that plant or any other. The indicating devices you have mentioned would confirm the belief that such actual experiences were encountered at this plant.

RDQ. 556. And assume that it was attempted to govern the water wheels of that plant by means of this load-weighting device we are discussing, independently of any hand controls, what would you say under the conditions pertinent to the changing head of water at that plant as to the results flowing from such increase in head and increase in load?

A. I would say that with this device disturbances in the speed would of necessity occur. By regulation of the plant I assume you mean the regulation by automatic control of the speed to maintain the speed or rate of rotation constant. This is absolutely essential in power plants, and all modern electric apparatus must, to successfully operate, be supplied with current at the proper electro-motive force, and this presupposes a maintenance of the proper speed on the electric generator, and the water wheels must therefore rotate the electric generator at a constant speed regardless of the load output. Any governing of the water wheel must, therefore, depend primarily for its sensitiveness upon any alteration of speed, or, at least, must correct any alteration of speed regardless of load. The device to which you have directed my attention and as shown in "Berry Blueprint No. 1," and "Defendant's Exhibit MZ," is a load-governor, or dynamometer, and is sensitive to load only. The load as weighed or indicated by the position of the weights and levers in this dynamometer is made up of the rotative speed resulting in a certain definite centrifugal force, and, in addition to this, the springs and the pull between the two shafts through the links "DD¹" is such that the levers "EE¹" may occupy positions intermediate be-

tween their full inward and outward positions for different speeds, occupying frequently the same position for two radically different speeds, it only being necessary that the load change without the speed changing in order to move them. Or, to put it in other words, the load being reduced and the speed being simultaneously increased to the corresponding degree, the levers will not move and therefore the governor would not be set into operation. And, vice versa, if the load be ~~increased~~^{reduced} and the speed simultaneously reduced, the levers will occupy their same position and no governing movement will occur. We here have the condition where the speed changes which are fatal to electric service without the governor acting to cause a correction or return to the correct speed.

RDQ. 557. Yes. You were right in your assumption that by controlling this plant I meant controlling or attempting to control the speed of the water wheels. Now, when any such attempts as were made at that plant by the use of this dynamometer as you have termed it were made, was it possible for any correction of speed to be made without a change in position of the levers "EE1", and, therefore, a relative movement between the water-wheel shaft and the generator shaft?

A. For any correction to be made of the speed of the water-wheel shaft by a movement of the water-wheel gate, it would be necessary for these levers to first move.

RDQ. 558. And that would result, or would it not, from a disturbance of the coupled relation between the generator shaft and the water-wheel shaft?

A. It would result in a greater or less displacement in

the rotative direction between the two shafts. This would cause material fluctuations in the cycles or alternations of any alternating current electrical apparatus being driven therefrom, which would also be fatal to good electric service.

RDQ. 559. And before there could be any correction of the speed of rotation of the generator shaft there would have to be an increase or decrease of the torque or twisting effect, as between the generator shaft and the water-wheel shaft. Is that correct?

A. That is true.

RDQ. 560. And therefore this dynamometer was not responsive purely to variations of speed of the water-wheel shaft, but to the relative variations of speed of the water-wheel shaft and the generator shaft. Is that correct?

A. That is correct, absolutely; such relative displacement being measured in this dynamometer, of the load.

RDQ. 561. Now, in this "Complainant's Exhibit A," the patent in suit, what is the relation between the sensitive element of the governor and the water-wheel shaft, and by that I mean the sensitive element which sets the other parts of the governor into motion.

A. The element is sensitive to the voltage variations and, therefore, in direct proportion to speed, absolutely regardless of load.

RDQ. 562. Would such a device as this dynamometer in which conflicting effects of change of speed of the water wheel and change of load on the generator might prevent any movement of the dynamometer parts, be a dependable governor for maintaining constant the rate of rotation or speed of the generator shaft?

A. It would not under any conditions if coupled as here shown. If the two shafts were rigidly joined together and the centrifugal effect only of the weights and levers in this device were utilized for the purpose of setting into movement some train of mechanism for shifting the gates, it might under such conditions be used for a centrifugal element sensitive to speed and not load. But this would require the coupling together of the shafts, and the design of the parts to be sensitive to centrifugal force only, and not transmission of any load. This would of course, be an entirely different construction, and would merely become, under such conditions as I have indicated, a centrifugal rotating element.

RDQ. 563. And under those conditions would it be a flexible or yielding coupling between the generator and water-wheel shaft?

A. Absolutely not. There would have to be a rigid connection between these two shafts, or, at least, a connection into one, transmitted through any part of this dynamometer, as indicated in "Defendant's Exhibit MZ".

RDQ. 564. And since this dynamometer is a flexible coupling between the two shafts, is it possible for it to measure and indicate any governing act responsive to changes purely in speed of the generator shaft?

A. It is not.

RDQ. 565. And is or is that not true with respect to the speed-sensitive governing element of "Complainant's Exhibit A," the patent in suit, namely, the dynamo "8"?

A. It is.

RDQ. 566. When you were last at this Power, Tran-

sit & Light Company plant, at the mouth of the Kern River Canyon, some three weeks ago yesterday, did you observe there any such device as this dynamometer you have told us about?

A. I observed parts of what I believe to have been the device indicated in these "Exhibits MZ" and "Berry Blueprint No. 1" and "Cobb Blueprint No. 1."

RDQ. 567. What, if anything, was the office of these parts then and there observed?

A. The fly-wheel "M" in "Exhibit MZ" was coupled up rigidly with both shafts, or, at least, there were no governing elements for transmitting any speed or load-sensitive movements from such mechanism. There may have been a flexible link or a fibre link or disc between the water-wheel shaft and the generator shaft, but there was no possible means for any rotative displacement between the two shafts, this element having been entirely cut out of it, if it existed. The shafts were to all intents and purposes, as far as any governing could be concerned, rigidly connected together.

RDQ. 568. By means of such a dynamometer, in the attempt to use the same to control or maintain constant the speed of the water-wheel shaft, for counter-acting speed for load changes, or, as you have testified, to produce any movement of the dynamometer parts to institute governing, would such a dynamometer be reliable as a water-wheel speed-controlling device?

A. It could not, under any conditions that I imagine, be satisfactory as a water-wheel speed-controlling device.

RDQ. 569. Could it or could it not perform the func-

tion of a water-wheel governor being the subject of "Complainant's Exhibit A," the patent in suit ?

Mr. Westall: Objected to as calling for a mere conclusion on the part of the witness and not calling for any comparison of structures, or any evidence of fact, or any description of any device contained in either of the devices.

A. It can not.

RDQ. 570. By Mr. Blakeslee: In the governor of "Complainant's Exhibit A," is it, or is it not possible for any change in the speed in the water-wheel shaft to occur without a responsive action of the governor or a tendency of the governor to respond, initiated by the responsive action of the speed-sensitive device named in the dynamometer "8"?

A. It is not.

RDQ. 571. And in the use of the dynamometer of the defendant's exhibits we are discussing, is it not or is it possible for changes in speed of the water wheel to occur without any responsive action of the dynamometer to initiate water-wheel speed regulation in this dynamometer?

A. It is.

RDQ. 572. If such a dynamometer device were used in an attempt to regulate water-wheel speed in a hydro-electric plant, what would result to the electrical energy consumers upon the current supplied by the plant because of such failure of the dynamometer governor element to act at all times responsive to changes in speed of the water wheel or wheels?

A. Fluctuation in voltage, as a result of fluctuations

in speed at the power house, which voltage fluctuations would cause a variation in the speed of motors and a variation in the illumination of incandescent lights. Either or both of these results would be termed very unsatisfactory electric service, occasioning great inconvenience, expense and disaster to the consumers.

RDQ. 573. Have you also examined these exhibits now under discussion, and particularly the blueprints thereof, with respect to the remaining device attempted to be portrayed therein?

A. I have.

RDQ. 574. Now, assuming that the alleged by-pass valve "41" capable of action to by-pass water from the pipe line around the water wheel, and the same were attempted to be operated by the dynamometer of the defendant's exhibits which we have just been discussing, and that this dynamometer were also operatively connected with the water-wheel gates shown in these exhibits, would or would not therein exist the combination with a speed-sensitive governor element of a water-wheel gate and a by-pass valve adapted to operate responsive to the control of the speed-sensitive governor element?

A. No.

RDQ. 575. You have heard the testimony of Messrs. Dearth, Sessions, Beal and W. W. Wilson, given on your behalf, in making these proofs?

A. I have.

RDQ. 576. What, as an engineer, would you deduce from their testimony and your knowledge of the present condition of the Power, Transit & Light Company plant, to have been the true nature of the attempt to operate a

central station by means of the Girard water wheels, or by means of any of the water wheels at that plant at all, so as to control the speed of the same through the dynamometer element we have now under discussion?

Mr. Westall: Objected to as calling for a mere conclusion of the witness and as calling upon the witness for an omnibus interpretation of the testimony of a number of witnesses.

A. That the apparatus was there installed in response to a strongly felt need, but that the design, construction and experimental work in connection with an effort to operate this apparatus, was purely of an experimental nature, the experiments being based upon misconception of the principles involved in this apparatus and the generic requirements to be met.

RDQ. 577. By Mr. Blakeslee: In your engineering practice have you ever known of such a dynamometer device or governor element in which speed factors and load factors might counteract each other to nullify action, to have been successfully employed for the purpose of regulating the speed of water wheels and maintaining constant generator speed.

A. No, sir.

RDQ. 578. How many different types of water-wheel governors, roughly speaking, have appeared and have been attempted to be used since 1897, when we are informed that this dynamometer device was attempted to be operated at the Power Development Company plant?

A. There are about six makers of governors in the United States, each of whom has brought out a number of types of governors since that time.

RDQ. 579. Have any of these governors utilized this dynamometer principle or load-weighing principle or principle of action, including the opposing of the speed factor to the load factor in affecting the position of parts of the governors?

A. I know of no successful governor along these lines.

RDQ. 580. Has the trend of development of water-wheel governors since the year 1897 at any time been toward such dynamometer device types of sensitive ~~gov-~~ governor elements?

A. Absolutely not. There have been a few erratic excursions from the field of purely speed-sensitive devices, but they have been quickly abandoned.

RDQ. 581. Referring now further to "Defendant's Exhibit Berry Blueprint No. 1," will you please state what, judging by the construction therein portrayed, would be the nature of the responsiveness of the by-pass valve "41" to the action of the various actuating parts intended to move the same to pass water around the water wheel or regulate its passage?

A. Its action could not be other than erratic. unreliable and unsatisfactory.

RDQ. 582. Please state your reasons.

A. On account of, primarily, the type of valve used. The valve shown on this exhibit is a plug-cock type of valve in which the valve surface must rub over its seat in order to vary the valve position, and, therefore, the port or discharge area. This friction element is a very large one, amounting in the exhibit you have shown me to several tons. This large friction even on the slightest movement of the valve, if it be only 1/16 of an inch,

places a load upon the governor which, even with the best possible modern type of governor would destroy its sensitiveness. This plug-cock type of valve indicates a total ignorance or disregard of the primary requisite in governor control valves. It is well known in the art today that a governor valve must be sensitive; that is, it must be capable with the least amount of effort to move from one position to another, commencing its movement quickly and stopping at an accurate predetermined point, determined by the governor speed-sensitive device, and that it must be as nearly balanced as possible and as free from friction as possible. Generically, the types of valve shown in "Berry Blueprint No. 1" and "Cobb Blueprint No. 1" do not meet these requirements as compared with valves of another genus. This I indicated in my testimony previously given in regard to "Wilson's Sketches A to E, Inclusive," in which the types of valves shown in Sketch A and Sketch B generically belong to the type of valve for use as governor-controlled by-passes, and as distinguished from the types of valves shown in "C, D and E." No one skilled in the art today under any conditions attempts to use a valve such as is shown in "Berry Blueprint No. 1" for by-pass control or water-gate control.

RDQ. 583. Judging by the scale of dimension of the parts attempted to be followed in "Berry Blueprint No. 1," please state whether, under the water pressures which must obtain in that plant upon the by-pass valve, judging from your inspection of the plant in its present condition, with its slope of penstock, and judging from the testimony and the exhibits in this case, what re-

sponsiveness could exist with respect to the attempted by-pass valve and the attempted dynamometer device with its lever arms "2-2", assuming that the changes in position of these arms sets in motion the train of parts ultimately acting upon the by-pass valve?

A. It could not be other than erratic, if it responded at all. I would not expect the device shown to be capable of moving the by-pass valve with any degree of certainty. The parts are entirely too light to carry any such load as would be imposed for such by-pass valve. I feel that the design of this by-pass valve indicates a total misconception on the part of the designer to appreciate the device involved, or the attainment of the end absolutely essential to successful adaptation of the by-pass, either to prevent inertia effects or to secure water economy.

RDQ. 584. Is any means provided with respect to this attempted by-pass device under discussion whereby the by-pass device might have been caused to return to a given or normal or customary position subsequent to its movement accompanying movement of the water-wheel gates?

A. No such parts are shown or even possibly indicated, in any of the exhibits disclosing or purporting to disclose the apparatus at the Power Development Company plant.

RDQ. 585. Did you hear the testimony of Messrs. Cobb, Berry and Van Emon and Dearth, which has been taken in this case?

A. I did.

RDQ. 586. Did you hear or read the testimony of any of such witnesses mentioning the provision of any

such arrangement or means for permitting or causing the attempted by-pass valve of this plant at any time to return to a normal or usual position after its movement accompanying water-wheel gate movement?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial. What the witness may have failed to hear cannot possibly affect any issue in the case.

A. Nothing of the kind was testified to as having been built or operated, or in any way involved in this apparatus.

RDQ. 587. By Mr. Blakeslee: What have you to say as to the practical operation of a hydro-electric plant utilizing a by-pass device which was in fixed relation to the water-wheel gates, so that after making the same movement in one direction or the other the by-pass valve could not return to a normal or usual position?

A. Such by-pass operation and adjustment is sometimes required in modern plants for the purpose of maintaining a constant flow of water, but it is rather unusual, as the by-pass is usually adjusted to return to its normal position to effect water economy.

RDQ. 588. What are the essential characteristics of a plug valve with respect to its mounting and accommodation in its case, and movement with respect to its seat?

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A. The substantial characteristics are inoperativeness as the result of the heavy friction element due to the rubbing of the valve upon its seat, as an essential to operation, and as generically distinguished from the types of valves used for successful governor control.

Mr. Blakeslee:

RDQ. 589. Is such a valve so responsive to the water-wheel governor action of any nature as to permit such governor to effectually take care of the conditions requiring governing?

A. They will not operate successfully with any governor to meet the conditions of the governing of water wheels.

RDQ. 590. Referring to "Defendant's Exhibit Berry Blueprint No. 1," what is the indicated relation between the water-wheel gates and the purported by-pass device, and the features intended to actuate the same, and related to the joint action of the same?

A. The intended action as disclosed in "Berry Blueprint No. 1" is that as the water-wheel gate moves in a closing direction, the by-pass valve be opened; and as the water-wheel gate is being moved in an opening direction that the by-pass valve be closed. The connection between the water gate and the by-pass valve are of a rigid nature, requiring invariably a movement of one when the movement of the other occurs, if the device would operate as intended.

RDQ. 591. Now, under these conditions, supposing the attempted by-pass device resisted attempted actuation or obstructed governor action, or interfered with it, what would be the effect upon the governor action in its relation to the water-wheel gate?

A. It would lock the water-wheel gates against movement, preventing the gates from responding to the effort of the governor, or some of the parts would be broken by the resistance of the by-pass valve to such motion.

RDQ. 592. Therefore, short of such breakage as you have mentioned, what would be the effect upon the governing action with respect to the water-wheel gates?

A. Inoperativeness.

RDQ. 593. In the purported disclosure of these two blueprints under discussion, and "Defendant's Exhibit XX," and "Defendant's Exhibit ZZ," and "Defendant's Exhibit MZ," do you or do you not find the combination with a speed-sensitive governor element of a water-wheel gate and a by-pass valve of pre-acting type only in engagement with its seat when closed?

A. I do not.

RDQ. 594. In order to properly come within the definition of "plug cock", what must be at all times the relation between the cock and its seat?

A. It must entirely fill the chamber, fitting its seat.

RDQ. 595. And be in what direct relation to its seat?

A. In contact with its seat at all times. Under the working conditions of hydraulic pressure against such valve, as will always exist in practice, the valve is naturally forced against its seat by such hydraulic pressure.

RDQ. 596. In the use of the governor element disclosed in the exhibits which we have been discussing and which you have referred to as the dynamometer, what have you to say with respect to the forces militating against responsiveness of action of the moving parts as compared with the corresponding action or permission of action or condition of action in a purely speed-sensitive governor element?

A. This dynamometer as indicated in "Berry Blue-

print No. 1" and "Defendant's Exhibit MZ" is designed with a total disregard to sensitiveness to speed, in that a speed-sensitive device must primarily consist of an element movable with a minimum amount of friction. Any friction that may exist, however slight, retards the sensitive movement of the speed-sensitive element, as such, preventing its movement. That is, such friction is a load preventing its movement. It will therefore be obvious that the greater this load be made the less sensitive will the speed-sensitive element be to slight speed variations. For example, in a fly-ball governor, if the weights or fly-balls be swung upon knife edges, the friction element is very slight and the weights will respond by swinging in a larger circle upon the slightest increase of speed, and, vice versa. In the case of the speed-sensitive element in the Lyndon invention as disclosed in "Complainant's Exhibit A," the patent in suit, the movement of the solenoid will respond very sensitively to speed changes, the friction element being absent in the springs and present to the smallest possible degree in the light moving parts and their pivotal supports which are actuated by the solenoid. If in a fly-ball governor the weights be suspended from large levers with large pivotal points, friction or initial load is introduced to a very damaging degree, preventing the sensitive response by the weights to a speed change. Any load that may be placed upon a speed-sensitive device greater than the minimum necessary to set into operation the governing motive power, militates directly against sensitive speed-control by such a governor, and anyone building a governor in which a load is placed upon the fly-balls other than the minimum, causing the

movement of the other governor elements, would produce exactly the contrary effects from those sought for. In the case of the alleged governor disclosed in "Defendant's Exhibit Berry Blueprint No. 1," and "Defendant's Exhibit MZ," the designer either in ignorance of or with a total disregard of the primary rules laid down above has artificially introduced in this dynamometer a load upon the centrifugal force of the weights, not only reducing, but, in the case before us, so much power or load is transmitted as to absolutely eliminate any possible sensitiveness of this device to speed fluctuation in comparison with what is demanded of a governor in the art. The device would have come nearer accomplishing speed-control had it not been a load governor at all, and the two shafts been rigidly connected together and the weights, arms and springs as shown in Fig. 1 been arranged responsive to speed and not at all to load. This would have given an approximation to a governor and would have indicated to my mind an understanding on the part of the designers of the principles involved. I have heard the testimony in this case, and read it, and I understand therefrom that the designers intended this as a load governor, it having been repeatedly called a "load governor", and a "load-and-speed governor", and "a dynamometer" by Berry, Van Emon and Cobb, and my conclusion from the scientific principles involved in this construction as outlined above, is borne out, therefore, by their testimony, where it is distinctly stated that it is responsive to load and speed, but is a dynamometer. A dynamometer is a load-measuring or indicating device, always. This device is not and never could have been a speed-sensitive device for water-wheel government.

Mr. Westall: Counsel for the defendant objects to the witness arguing the case and moves that the answer be stricken out as not responsive to the question and as argumentative, and not being a statement of facts in any respect properly within the issues of the case.

Mr. Blakeslee: The answer speaks for itself.

RDQ. 597. Do or do not the considerations you have mentioned in discussing this dynamometer enter, in your mind, into the reasons why this Girard water-wheel apparatus, with the attempted by-pass device, was thrown out of the Power Development Company plant and scrapped within a short time after its first attempted operation? And, if so, to what extent, and for what reasons.

Mr. Westall: Objected to as calling for a mere conclusion on the part of the witness without showing upon what those conclusions might be based, and as being argumentative.

A. The principles and results of operation of this device as set forth in my previous answer would cause the absolute inoperativeness, as far as sensitive speed indications for control, if built in accordance with "Defendant's Exhibit MZ," or "Defendant's Exhibit Berry Blueprint No. 1." Therefore, such a device could not have been of any use for the purpose of automatic speed control.

RDQ. 598. By Mr. Blakeslee. If you were informed that the Girard water wheels at this Power Development Company original installation developed an efficiency of more than 80%, what would you have to say, as a hydraulic engineer, as to the efficiency of these wheels as compared with the usual effectiveness of wheels?

A. I would say that the efficiency was particularly good. Eighty per cent all over is a high efficiency for wheels of this size and under this head in the very best water wheels made today, eighteen years after these wheels were built.

RDQ. 599. Would any competent, careful engineer advocate the discarding of water wheels developing such efficiency because of such efficiency factor?

Mr. Westall: Objected to as calling for a matter of opinion, outside of the qualifications of the witness, namely, upon the matter of what a careful, competent engineer might do or might not do under certain conditions, which conditions, as set forth, are not material to this case.

A. Any engineer who might reject tangential water wheels on the sole ground of lack of efficiency when he found the wheels were giving an efficiency of 80% or more, would, in my opinion, be incompetent.

RDQ. 600. By Mr. Blakeslee: In all of your experience as a hydraulic engineer, including your long connection with the Pelton Water Wheel Company, former intervenor in this case, as its chief engineer, did you ever know of a water wheel being rejected on the efficiency factor when it developed an efficiency of over 80%?

Mr. Westall: Objected to as incompetent, irrelevant and immaterial.

A. I never knew of a water wheel being rejected solely on the efficiency factor if the efficiency was 75% or greater.

RDQ. 601. By Mr. Blakeslee: Would the use of the attempted by-pass device as shown in the "Berry Blue-

print No. 1" and these other exhibits before us, and mounted and controlled as therein indicated, be feasible and practicable in a hydro-electric power plant in which saving of water was the important matter, and whatever your answer may be, please give the reasons for it.

A. No; it could not effect a saving of water in that the opening of the discharge of the water from the pipe line is intended to be present, and the assumption by the designer that the by-pass would be operative, in that if the water gates are partially closed it was his intention that the by-pass valve should be partially open, so as to maintain substantially a continuing flow of such water through the by-pass as had been rejected by the water wheel.

RDQ. 602. Referring now to "Defendant's Exhibit XX," please state what you gather from the disclosure of the features generally designated "J" therein, with respect to the character of mounting and arrangement of the attempted by-pass valve of these several exhibits before you.

A. In "Defendant's Exhibit XX" I believe "J" to represent a chamber in which there is a plug cock, or valve, substantially as indicated in "Berry Blueprint No. 1". This valve is of necessity in contact with its seat at all times, or such matter as may lodge upon the seat, and is therefore supported thereby. It is intended to be turned upon the seat by a stem and lever connection actuated from the cylinder "P" on the right-hand side, through the intervention of connecting links, which links also rotate the collar "R" and the gates "T". This collar "R" is evidently carried upon the sleeve "S", actuating also the gate "T" on the left-hand side.

RDQ. 603. From the showing of this Exhibit XX, has or has not the valve supposed to be in the casing "J" any other form of support or bearing than that afforded by the inner walls of the casing itself?

Mr. Westall: Objected to as calling for a mere guess of the witness, it being very evident that only the outer casing is shown in the exhibit referred to, and that unless the witness is equipped with an X-Ray gaze he cannot possibly observe what is contained inside of the casing.

Mr. Blakeslee: We do not assume that counsel now contends that there is any further casing than the outside casing, for in that case counsel would be contending that this photo print does not agree with "Berry Blueprint No. 1." We are assuming that the testimony of the witness for the defendant does not tend to establish a variance between these two purported showings of the same apparatus, and it is upon that testimony introduced by the defendant that we ask this question.

A. I cannot conceive how it could. From the testimony I have heard and read in this case I am convinced that it could not have any other support.

Mr. Westall: I move that the latter part of the answer as to the testimony read be stricken out as not responsive to the question, and involving an interpretation and conclusion which may be erroneous and which the witness has not fully explained, and which cannot properly be explained as part of the record.

RDQ. 604. By Mr. Blakeslee: Is there any showing on this "Defendant's Exhibit XX" to indicate any means of support of the purported by-pass device further than it may be in the casing "J", other than the round

surfaces of the casing "J", which contact with the periphery of the valve or its rounded working surface?

Mr. Westall: Objected to as assuming a construction which has not been shown to be the construction of the part referred to in the question, and on the ground that it is assuming that there is a frictional contact between the valve and its casing, and that the plug is not otherwise supported than by the casing.

Mr. Blakeslee: We will withdraw the question if counsel will admit the possibility of a variance between the showing of this exhibit and "Defendant's Exhibit Berry Blueprint No. 1." Otherwise the objection must fall.

Mr. Westall: Counsel will make no admission of any kind. The objection is simply to the assumption made by counsel as to the inner working and the interior arrangement of the part which is shown in the exhibit.

Mr. Blakeslee: If defendant's record left open a possibility of surmise as to these things, the court is not properly informed as to the construction of this Power Development Company plant set up by the defendant. That being the case, it is highly proper that we attempt to inform the court as far as the exhibits permit us to do so.

A. It certainly does not show any other support.

RDQ. 605. In this "Defendant's Exhibit XX" what means, if any, are provided for supplying energy in any manner to cause the operation of the part "P" and any parts which may be connected therewith?

A. From my knowledge of hydraulics, rams and cylinders as they are frequently used in hydraulic practice, I would consider that the device having the supplement-

ary piston connected at "A" and said device appearing slightly to the left of the cylinder "P" in smaller dimensions, but cylindrical, is a valve chamber having therein a valve connected with a rod at "O", and the lever "N" for controlling the flow of fluid to the cylinder "P". This evidently was the original intention of this device. However, there are no fluid connections anywhere observable to it, so that the device must, as here shown, have been inoperative, as pressure fluid of some kind would be essential to cause the operation through the cylinder or arm "P". Connections from the lever "M" evidently exist or were intended to exist up to the controller. But with the device as shown in this "Defendant's Exhibit XX," movement of the lever "M" would cause movement of the lever "N" and the piston "O", but without pressure fluid of the parts "QQ, K, R, T" or the by-pass valve or water gates, could possibly occur. In other words, the control element could not by the device herein shown cause any operation either of the water-wheel gates of the by-pass valve.

RDQ. 606. Referring again to "Defendant's Exhibit Berry Blueprint No. 1," and to the parts and features therein, which we have last referred to, namely, the apparently intended hydraulic cylinder "25" with its piston and piston rod "27" and the pressure fluid admitting-and-discharging valve "24", and the lever "21", link "22", stem "23" of such valve "24", and their various means of connection, all being apparently joined with the parts which extend to the attempted by-pass device and the water-wheel gates for actuating the same, will you please state what you understand, by this blue-

print supplemented by your understanding of the same in the light of the testimony of the witnesses in this case who have treated of these parts, the action of such parts would be and the effects of such action.

A. I agree with the other witnesses in that the tendency to action would be as they have testified, providing this valve mechanism were supplied with proper pressure fluid; but I disagree with any testimony which is to the effect that this apparatus would be operated responsive to speed changes, or that synchronous, inverse and satisfactory operation of the by-pass valve "41" and the water gates as indicated at "48" could possibly exist to maintain normal speed on the water-wheel shaft under load changes coming upon the generator.

RDQ. 607. What have you to say further with respect to the action of these parts and features directly with relation to the movements or offices of the valve "24" within its case, and the effects of its performance upon the water-wheel gates and attempted by-pass device?

A. The movement of the pilot valve "24" in "Defendant's Exhibit Berry Blueprint No. 1" in a direction toward the wheel shaft would permit pressure from the central pipe shown immediately over the figures "24" to be admitted to the upper portion of the cylinder "25", causing its piston rod "27" to move in a direction away from the wheel shaft center. This movement of the rod "27" would, through the agency of the lever "21", momentarily fulcrum at "20", causing a shifting of the valve "24" in a reverse direction from that which it originally pursued and toward the operation of the rod

“27”, and, therefore, such movement of the rod “27” would reverse the movement of the valve “24” to a position cutting off the further supply of fluid to the cylinder “25”, and, therefore, stopping its action upon the rod “27” to open the water gates and by-pass valve connections.

RDQ. 608. Now, considering further the disclosure before you as of “Berry Blueprint No. 1,” now assume the fact that the lever “21” is indicated as connected up with the dynamometer device which we have previously discussed, and assume that the actions you have just described have taken place under some change of position of the parts of this dynamometer, and that an attempted correction of the water wheel speed is being made, in result of such performance, what have you to say further as to the action of the parts which you have last considered?

A. A speed change and load change might occur without movement of the dynamometer parts. But if, whether it be for load or a combined load-and-speed change that the dynamometer parts may have moved, such movement will cause a corresponding and proportional movement of the lever “21” which will for the moment fulcrum about the pivot “28”, therefore causing the proportional movement of the rod “23” and the valve “24”. Any movement of this valve “24” results in immediate movement of the piston “26” in a reverse direction, causing the bringing back of the valve “24” to its normal or closed position. There will, therefore, occur following any movement of the dynamometer parts a proportional movement first of the valve “24” and, therefore, a proportional movement of the piston “26” in an inverse di-

rection thereto. This, of course, assumes that there is power fluid available for the operation of the piston "26" through the valve "24", this being fed through the central pipe over the figure "24" into one end of the cylinder "25", and being discharged from the opposite end of the said cylinder through one or the other of the two discharge pipes, as indicated by the arrows.

RDQ. 609. After this valve "24" has been brought back to its seat in the governing or attempted governing action, will it or will it not remain there until the governing action has been completed, and give your reasons.

A. It is not brought back until the governing action has been completed, as regards the governing action of a single movement of the dynamometer elements. If there is a further movement of the dynamometer elements as a result of any movement of the water gates now following, there will be a corresponding further disturbance of the valve "24" and the piston "26". Such movements will occur following every movement of the dynamometer movable element if the device works as it was intended it should.

RDQ. 610. And what will be the result with respect to prompt and proper establishment of the proper new condition or position of the water-wheel gates and of the purported by-pass device if it accompanies water-wheel-gate movement?

A. Some portion of the governor in operative combination with the speed-sensitive device thereof should be in engagement during the entire period of speed return from its disturbed condition to its normal condition after the gates have been set in motion. Such is not the

case in this device, because the device would operate so that upon a displacement of the weights or movable parts of the dynamometer from normal position, due to an abnormal load or load-and-speed, the gates will or should take with this device, a new position for such new condition. The valve "24" being thereupon closed to its normal position by the movement of the piston "26", as I have previously testified, the entire device is now in equilibrium at the increased or decreased load or load-and-speed changes, at a higher or lower speed than normal. There is now no tendency for it to return to normal speed, and it will remain in such equilibrium at the higher or lower than correct speed indefinitely, thus failing to accomplish the primary essential of speed regulation. There is no device in this apparatus in operative engagement to prevent the over or under-running of the governor, or to return the speed to normal before it has overrun.

RDQ. 611. And in default of such ever-running preventative, what occurs with respect to the parts we are discussing, including the valve "24", the piston "26", and the connecting parts or what is missing as applicable to these features to prevent over-running of the governor?

A. The effect will be that the voltage will be higher or lower on the system than normal, for an indefinite period. Change would result in incandescent lights burning higher or more brightly or being dimmer than they normally should be. If this device were sufficiently sensitive to be actuated for reasonable changes of speed, the governor would "hunt", that is, over-travel back and

forth, first raising and then lowering the speed through a series of cycles, causing the flickering of lights. This condition would occur whenever the load changes were great enough to overcome the heavy friction involved in this type of dynamometer. The effect would therefore be in cases of considerable load change or load-and-speed change, that the governor would "hunt" or overrun to a defective, if not dangerous degree; or else, if the load change or the load-and-speed change were very small, the result would be a decrease or increase in the speed and in the illumination of incandescent lights supplied therefrom. I might say that this governor will invariably overrun, if it controls at all, and that to prevent such overrunning it would be necessary to add a further element compensating for the rate of speed return to normal, and holding the valve "24" upon its seat during the said return to normal instead of permitting it to overrun as it would do if the said valve "24" were connected up as shown to a speed-sensitive element or a speed-and-load sensitive element or load-sensitive element. This is the element mentioned in the first part of my answer as essential where a speed return to normal is desired.

RDQ. 612. In other words, it is correct to say that in this "Berry Blueprint No. 1",—or is it correct to say that there is any lack of an element which causes the valve "24" to return to its normal or closed position and to stay there during the final movements of the speed-sensitive or load-sensitive or speed-and-load sensitive device, whichever may be utilized to actuate this valve, so that the valve shall not permit the piston "26" to act in a disturbance of the water-wheel gates from the new

position assumed by them consequent upon a change of speed or load.

A. No such element exists in this device as disclosed in "Berry Blueprint No. 1." And the operation of the device as here disclosed would be that the gates would take an improper position for the final new load, and either maintain this position, resulting in an incorrect speed, or would move back and forth a number of times in an effort to find such speed. This applies whether the dynamometer form of sensitive device be used or a speed-sensitive device be used.

RDQ. 613. Therefore, is there or not disclosed in "Defendant's Exhibit Berry Blueprint No. 1" the means for performing the functions of a returning device disclosed in "Complainant's Exhibit A," the patent in suit, and including the clutch-discs "22" and "23" and the rod "25", the springs "27,28" and the means for throwing into and out of connection such enumerated parts.

A. No such device or its mechanical equivalent exists in the device disclosed by "Berry Blueprint No. 1," or "Defendant's Exhibit XX," or "Defendant's Exhibit MZ," or "Defendant's Exhibit Cobb Blueprint No. 1."

RDQ. 614. And how with respect to the functions of these last enumerated parts and the functions of the "Berry Blueprint No. 1" device we were discussing?

A. No such functions are found in the said defendant's exhibits.

RDQ. 615. You heard the testimony of Mr. S. L. Berry, a witness on behalf of defendant in this case?

A. Yes, sir.

RDQ. 616. Referring to the testimony of Mr. Berry

Berry contained in the question and answer number 196 on page 912 of the record, and in which Mr. Berry says: "The power cylinder 'FF', together with the piston head within said cylinder, the piston rod connected thereto, do not form a clutch-gear nor do they in any manner perform the functions of a clutch-gear. Will you please compare these parts with respect to their clutch-gear actions and functions, and specify in what respects?"

A. The fluid-actuated piston in the cylinder of the Lombard governor acts in every respect the part of a clutch in mechanics, in that it causes connected operation or interruption in operation of the parts connected thereto and intended to be operated on governor movement. Such is the function of all clutches in mechanics.

RDQ. 617. Are you able to produce any certified copy of the record of the Patent Office of any patent application resulting in any patent issued to Lombard or to the interests of the Lombard Governor Company of Ashland, Massachusetts, which patent issued subsequently to the patent in suit?

Mr. Westall: Objected to unless it is shown that such patent had some bearing in some way upon the issues of this case.

A. I am. I have such certified copy. (Witness produces certified copy of file wrapper and contents of patent issued to Nathaniel Lombard, assignor to the Lombard Governor Company, March 18, 1902.)

Mr. Westall: In view of the answer and the production by the witness, the question is objected to as incompetent, irrelevant and immaterial, and as not proper rebuttal. If it is desired to introduce this file wrapper

because of any statements or admissions by any third person not a party to this suit, it is objected that any such admissions or statements would be mere hearsay and an entirely improper method of proof.

A. This file wrapper indicates the application to have been filed by the said Nathaniel Lombard on December 12, 1901.

Mr. Blakeslee: This line of evidence, as we will show, pertains to the state of the art, including the invention of the patent in suit, and to the alleged infringing structures, and will be shown to be proper rebuttal in dealing with these alleged infringing structures, and the testimony and evidence adduced on behalf of the defendant with respect thereto. The certified copy of the record of the Patent Office constituting this certified copy of the file wrapper and contents is, we contend, competent evidence as to the state of the art at times pertinent to the pendency of this application, and as to the state of the art as admitted by the applicant for the Lombard patent in question by his volunteer disclosures pertinent to this invention, as a matter of public record, under the certification made. And it will be seen that this application, although filed after the application for the patent in suit, was co-pending therewith and was, therefore, part of the state of the art directly before the Patent Office at the time that the application for the patent in suit was pending.

Mr. Westall: It is objected that the certified copy referred to in the first place is not proper evidence of the state of the art at the time referred to, it being composed of statements, perhaps admissions, and arguments

to the Patent Office by a person not produced and sworn in this case as a witness, and, therefore, there is no opportunity afforded for the cross-examination of the person or persons making any such statements as to the alleged condition of the art at the time mentioned. Furthermore, both the application and the patent granted thereon, if such a patent were granted, were made after the application for the Lyndon patent in suit, and long after the alleged invention of the patentee of the Lyndon patent in suit. They therefore could not by any possibility show the state of the art prior to the Lyndon invention or prior to the date of the application for the Lyndon patent in suit, and, therefore, are entirely incompetent, irrelevant and immaterial. Objection is also made that said purported patent has not been in any way connected heretofore with any of the alleged infringing devices or any of the devices which have properly been inquired about during the progress of taking proofs in this case.

Mr. Blakeslee: Further, as will develop, the subject matter of these letters patent concerned in this certified copy of the file wrapper and contents will be compared with certain parts of the alleged infringing construction, and thus it will be made clear by proper proof of connection between the two that this is proper evidence, pertinent to the understanding and explanation and consideration of said part of the alleged infringing structures. The document is not offered, of course, for more than it is worth as evidence; but its pertinence to the issues will be developed as its consideration develops by proper comparison.

Mr. Blakeslee: Complainant offers in evidence the certified copy of the file wrapper and contents just produced by the witness, as "Complainant's Exhibit Certified Copy of File Wrapper and Contents Lombard U. S. Patent 695464."

Mr. Westall: Counsel for the defendant objects to receiving in evidence the paper offered upon the ground that it is largely in the nature of hearsay evidence, in that it consists of correspondence between an applicant and the Patent Office, in which arguments and statements are made by persons who are not produced and sworn to testify as witnesses, which thereby results in a deprivation of every opportunity for cross-examination on the part of the defendant. The objections to the consideration of this exhibit and the questions relating to it, are also repeated as objections to the introduction of this exhibit in evidence.

Mr. Blakeslee: Counsel's attention is called to the fact that the application involved in this certified copy of the exhibit was, as shown, allowed upon the first action of the Patent Office and there is no argument reflected as between the Patent Office and the applicant. However that is merely an observation for the purpose of the record.

Mr. Westall: Notwithstanding the want of correspondence between the applicant and the Patent Office pointed out by counsel, the contention will doubtless be made that an argument is implied or an admission is implied by the Patent Office in the statements made by the applicant, by failure on the part of the Patent Office to correct, object to, or disagree with any statements made

by the applicant, and, therefore, this implied admission might be construed of as great weight as an express statement by the Patent Examiner that he did agree with the matter contained in the application.

(The said document so offered in evidence is thereupon marked "Complainant's Exhibit Certified Copy of File Wrapper and Contents Lombard U. S. Patent 695464.")

RDQ. 618. By Mr. Blakeslee: Do you know whether there is any connection between this Lombard Company, the assignee of this patent in this exhibit, and the Lombard Governor Company which has been testified to be the manufacturer of "Complainant's Exhibit W," and other governor mechanisms referred to in this case?

A. They are one and the same company.

RDQ. 619. Is there any comparison possible between the disclosures of this patent and the patent a copy of which is included within this exhibit, and within the certification thereof, and "Complainant's Exhibit W?"

A. Yes.

RDQ. 620. In what respects?

A. "Exhibit W" exemplifies and contains the invention set forth in this patent No. 695464.

RDQ. 621. Now, with respect to the alleged infringing structures as depicted in "Complainant's Exhibits E to L, Photographs," and further exemplified by other of complainant's exhibits depicting the alleged infringing structures, such as "Complainant's Exhibit KKK," is it possible to trace any relation between the disclosure of this exhibit and such other complainant's exhibit?

A. The device disclosed in this Lombard patent No.

695464 is in use in the Lombard governors at the Cottonwood and Division Creek plant of the City of Los Angeles on the Los Angeles Aqueduct System as exemplified in "Complainant's Exhibits KKK and LL."

RDQ. 622. Will you please read from this file wrapper and contents exhibit such excerpts as you may make

2208 8½ add "together with the title of the court and cause and the date upon which the said exhibit was offered in evidence.

shall throw light upon the operation and functions of the structures including "Complainant's Exhibits E to L," and "KKK" and "LL", and as likewise relating to the construction and inter-relation of parts in "Complainant's Exhibit W."

Mr. Westall: It will be understood that all objections heretofore made to the consideration and to the introduction in evidence of the exhibit referred to in the question are renewed and repeated to all the questions relating to the exhibit, without burdening the record by their repetition after each question.

A. Reading from the certified copy of the file wrapper and contents of U. S. Letters Patent 695464, issued to Nathaniel Lombard, assignor, and assigned to the Lombard Governor Company, in the specifications forming part of said Letters Patent I find, commencing on line 9 of page 1: "The improvements relate to speed-regulators, particularly of the class shown and described in my Letters Patent No. 533,656, dated February 5, 1895, in which the valve that regulates the speed of the engine, or other prime motor, is opened and closed by the movement of weights which are acted upon by cen-

trifugal force when they are revolved; and my invention consists in improvements in the construction shown in said patent by which said valve is quickly, yet moderately, returned to its normal position, whenever that has been disturbed by the action of said revolving weights, and by this means the so-called 'racing' of the engine or prime motor is prevented, as also the pounding of fluctuation from one extreme of speed to another by reason of the alternate opening and closing of the valve caused by the vibration of the said weights. In my said prior patent this valve is returned to its normal position by the action of a spring which works against liquid in a cylinder which is caused to circulate from one side to the other of a piston therein with greater or less rapidity in accordance with the size of the opening in a manually-adjustable gate in the passage which connects the two ends of said cylinder, while in my improved construction the gate or valve in said connecting-passage is automatically opened and closed when the said cylinder is moved in one direction and then the other. The construction and operation of these improvements will be readily understood from the description hereinafter contained in connection with the accompanying drawings."

And line 71 of page 1: "Like the mechanism shown in my said prior patent, the present improvements are intended to be employed in the regulation of what I term the 'secondary' valve—that is, one which supplies the motive power to mechanism which operates the primary valve or gate that furnishes the motive power to the prime motor. In the first instance the centrifugal governor, which is revolved by direct connection with

the prime motor, acts upon this secondary valve to move it in one direction or the other in accordance with the variation of speed in the prime motor due to a decrease or increase of the load or amount of work put upon it. Such change of the secondary valve supplies the motive force to the mechanism which operates the gate of the prime motor, and by the connection of this mechanism with my improved regulating devices these devices are caused to act immediately upon the secondary valve in a manner to counteract the effect thereon of the last previous action of the centrifugal governor, and thus return the secondary valve to its normal or closed position, and this is the constant tendency of my improvements whenever the secondary valve is moved from its normal position."

Referring to page 2 of the said specifications, commencing at line 44 and referring to the former patent issued to this inventor, to-wit, No. 533656, he says: "The alternate movement of the rod d' with the attached secondary valve first in one direction and then the other by the swinging out and in of the weights c' produces a very injurious effect upon the engine or prime motor by quickly increasing and decreasing its speed, and sometimes when the load is suddenly taken off the prime motor, it will 'race' to such an extent as to cause injury, and my improvements are intended to obviate these difficulties."

The inventor further in his specification, and referring particularly to Fig. 4, commencing at line 108, page 2, says: "The lower end of this rod—g⁵ is beveled off at an obtuse angle upon two sides of a diametrical line, and

beneath the end of the rod there rests upon the projection f a piece of metal g¹⁰, which has a flattened V-shaped groove g¹¹ in its upper surface, the angle of the faces of which groove is the same as that of the beveled faces of the lower end of the rod g⁵, but considerably greater in extent. When the parts are all in normal position, the apex of the beveled end of the rod g⁵ should rest in the bottom of the groove g¹¹, as shown in Fig. 4. The metal piece g¹⁰ is pivotally secured at e⁸ to an angular clamp e⁹, which is bolted to the frame e¹ at e¹⁰. Small h is a screw-plug to close an opening through which the chamber g and cylinder f¹ are filled with liquid, probably oil."

On page 3 of the specifications, line 11, the inventor says: "The operation of my improved construction is as follows: It will be understood that the piece g¹⁰ is prevented from moving horizontally by its engagement with the angular clamp e⁹, which is bolted to the frame e¹, although the end containing the groove g¹¹ may move up and down as required upon the pivot e⁸. Referring to Fig. 4, where all parts are illustrated as in their normal position, with the apex of the angular lower end of the rod g⁵ in the bottom of the angular groove g¹¹ of the piece g¹⁰ and with the rod g³ so adjusted that at this time it closes the port g², we will suppose that suddenly a large amount of load is taken off the prime motor. Immediately its speed will be increased, thus causing the weights c¹ of the centrifugal governor to be thrown outward, which action will draw down the collar c⁴ and by its contact with the sleeve d³ towards it, with the attached rod d¹, downward, and also the secondary valve

on the lower end of that rod. This movement of that valve will open the ports which admit motive power to act upon the mechanism connected with the gate of the prime motor and tend to close that gate. As the lower end of the lever f^4 is connected with the same mechanism, it also will be moved from the position shown in Fig. 4 to that shown in Fig. 6. At the same time the liquid-circulation chamber f^1g and the attached rack e^2 will be moved horizontally to the left, as shown in Fig. 6. This movement of the rack e^2 which is in engagement with the pinion e , will cause the pinion and the rod d^1 to turn from left to right, and thus screw the upper end of the rod into the sleeve d^8 , shorten the rod, and raise it with the secondary valve at its lower end, and thereby tend to close the valve and counteract the previous effects of the centrifugal governor upon it. The movement to the left of the cylinder f^1 and rack e^2 will continue until the port g^2 has been opened sufficiently to permit a free circulation of liquid in said cylinder and the chamber g . The first movement of the upper end of the lever f^4 to the left will carry the cylinder f^1 and its attached mechanism with it, and as the piece g^{10} is secured to the frame the end of the rod g^5 will slide up the inclined surface of one side of the angular groove g^{11} therein, and through the connecting-link g^4 the valve rod g^3 will also be raised, and thus open the port g^2 and permit a circulation of liquid from one side of the piston f^2 up through the port g^2 and down through the port g^1 into the cylinder f^1 upon the opposite side of the piston f^2 . The resistance of the liquid in said cylinder being thus removed from the piston, the spring e^5 , Fig. 2,

by means of a finger e^3 will force the rack e^2 and cylinder f^1 back again—that is, to the right—and the piston f^2 will tend to assume the position illustrated in Fig 6. This reverse movement of the rack e^2 will turn the pinion e and rod d^1 in the opposite direction—that is, from right to left—and unscrew the rod from the sleeve d^3 , thereby lengthening the rod and forcing the secondary valve downward, thus tending to open that valve again. However, as the action of the centrifugal governor by reason of the increased speed of the prime motor tended to open the secondary valve and operate mechanism to close the gate of that motor such closing would decrease the speed of the motor and at the same time the speed of the centrifugal governor, the action of which would tend to close the secondary valve and if otherwise uncontrolled would be liable to continue its action in the same direction and open other ports of the secondary valve, which would admit motive power to set in operation the mechanism to again open the gate of the prime motor; but, as explained above, the movement of the rack e^2 to the right would turn the rod d^1 , so as to lengthen it, and thus move the secondary valve downward, which would compensate for the tendency to raise that valve by the action of the centrifugal governor when its speed of rotation was decreased, so that whenever the centrifugal governor acts upon the secondary valve to put in operation the mechanism which tends to open or close the gate of the prime motor, that same mechanism acts upon the rack e^2 to move the secondary valve first in a direction opposite to that produced by the governor thereon and then automatically and stead-

ily to return said valve to its normal or closed position, and at the same time by automatically closing the port g^2 between the cylinder f^1 and the chamber g prevents circulation of the liquid, and by that means prevents the movement of the piston in the cylinder f^1 . Thus a practically rigid connection between the lever f^4 and the rack e^2 will be formed, which will cause the beginning of each impulse of the lever f^4 to act quickly and positively upon said rack to counteract the effect produced upon the secondary valve by the governor."

RDQ. 623. By Mr. Blakeslee: What if any relation exists between the mode of operation and function of the water-wheel governor disclosed in the patent from which you have just been reading excerpts, and the water-wheel governor of the patent in suit, "Complainant's Exhibit A," with particular respect to the returning devices comprising the clutch disc "22-23", means of engaging and disengaging the same, and means of operating ^{vs} connection between the same and the other controlling features of the governor?

A. They accomplish substantially the same results in substantially the same manner and by substantially the same means.

RDQ. 624. Are you able to produce at this time a photograph of "Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898," made under your direction?

A. I have, and I now produce the same.

Mr. Blakeslee: The same is offered in evidence as "Complainant's Exhibit Photograph of Complainant's Exhibit Lyndon Reproduction Sketch of his Disclosure Sketch of June and July, 1898."

Mr. Westall: Counsel for defendant objects to the offer and to receiving in evidence of the exhibit referred to on all the grounds urged to the original sketch of which the present exhibit purports to be a photographic copy.

(The said photograph so offered in evidence is marked "Complainant's Exhibit Photograph of Complainant's Exhibit Lyndon Reproduction Sketch of His Disclosure Sketch of June and July, 1898.")

Mar. 13, 1915. A. M.

RDQ. 625. Referring again to the installation of the Power Development Company in the Kern River Canyon as purported to be illustrated with respect to the installation in "Defendant's Exhibit Berry Blueprint No. 1" and "Defendant's Exhibit MZ," I will ask you please to assume that the load upon the generator and wheels operated thereby is to be considered as the call for electrical energy, and then to further assume the following conditions of attempted operation: First, an increase of head with an increase of load, together with a constant main-gate opening; second, a decrease in head with a decrease in load, with a constantly maintained main-gate opening; third, an increase in head with a decrease in load, with a constantly maintained main-gate opening; and, fourth, a decrease in head with an increase in load, with a constantly maintained main-gate opening. And then, based upon the interpretations given by your testimony of the action of the dynamometer of this plant in the attempted operation, please state what in each of the cases put would be the accompanying action or attempted action of this dynamometer,

and what would occur with respect to water-wheel governing responsive to each of the particular sets of conditions set forth, dealing particularly with the factor of speed and the effect upon the voltage conditions in the circuits supplied by the generator, due to variations that will occur, particularly considering this speed factor.

2216 10 add "together with the title of the court and cause and the date upon which the said exhibit was offered in evidence."

with a properly designed governor and its accompanying apparatus result in the maintenance of a constant speed. With the dynamometer device of "Berry Blueprint No. 1," and "Defendant's Exhibit MZ," because there has been an increase of load, the tendency will be to draw the levers "EE' " inwardly. Depending on the degree of load and head change, there will be either an increase or decrease of speed. Under the second condition you have mentioned, my answer is the same with the difference that the levers will have a tendency to move outwardly. Under the third condition you have mentioned, there being a decrease in the load, the levers "EE' " will move outwardly, corresponding with an increase of speed. In the fourth case you have mentioned, the levers would move inwardly, responding with a decrease in speed. To make this matter clear, the action of the weights and lever "EE' " is caused by load changes and not speed changes, and a great number of different positions and, therefore, speeds may be attained. With the same originally impressed load and

for any given lever position a number of different speeds will undoubtedly exist.

RDQ. 626. Now, particularly with respect to the third and fourth cases, what will be the only possible action of this dynamometer with respect to establishing the proper speed conditions of the water wheel and generator driven thereby?

A. The device will not actuate to maintain a constant speed.

RDQ. 627. And what will be the results from a commercial standpoint of attempting to operate such an apparatus?

A. In practical operation of an electric system supplied from a generator and water-wheel equipment with dynamometer control as indicated on "Berry Blueprint No. 1," assuming it to work as there disclosed, there will be upon increased loads thrown on the apparatus a decrease in speed; and upon decreasing loads an increase of speed. These variations in speed will result in decreased voltage in the first case and an increase of voltage in the second case, whereas, the voltages should remain the same in both cases.

RDQ. 628. And, with such voltage variations, from a commercial standpoint what would be the results?

A. There would be with increased voltage an over-speed of the motors or an over-illumination of the lights, and this over-voltage would frequently result in damage to the lights or motors if excessive. With under-speed and under-voltage there would be a decrease in the illumination of the lights and a slowing-down of the motors. If the apparatus is alternating current apparatus,

as it almost universally is in power transmission work, the increased speed would also correspond with an increased number of cycles, and the decrease in speed with a decreased number of cycles, causing damaging variations in the speed of motors and driven apparatus.

RDQ. 629. Would these contrary and objectionable effects or results be obtained, assuming that a purely speed-sensitive device under the same other conditions were substituted for this dynamometer device?

A. No; they would not, with the speed-sensitive device such as disclosed in the patent in suit.

RDQ. 630. Now, apart from any consideration of change of head, and still assuming the attempted operation of this dynamometer device of "Berry Blueprint No. 1," what would be the effect upon the voltage of the circuit supplied by the generators produced by an increase of load and decrease of load, respectively, assuming the lever arms "E" and "E'" to be at definite positions off their seats.

A. An increase of load will result in the retardation of the speed with its attendant defects. A decrease of load will result in an increase of speed with its attendant defects.

RDQ. 631. And subject to any possible speed-correcting action of this dynamometer, will these lever arms, or will they not, be brought to their normal positions related to any given load?

A. They will occupy always a position of equilibrium between load and speed. That is, for any given position of these levers they will so remain for a proportional

increase in speed and decrease in load, or increase of load and a decrease in speed.

RDQ. 632. Then is it or is it not true that these lever arms may occupy different positions for the same load?

A. That is true.

RDQ. 633. And what is the result of that possibility with respect to the maintenance of a constant speed of the water wheel?

A. A variation in the speed inversely to the load.

RDQ. 634. And what is the effect of such variation with respect to maintaining a proper voltage upon the circuit?

A. It would be impossible to secure satisfactory service under these conditions and with this dynamometer.

RDQ. 635. Then, in order to in any manner approximate proper service with the maintenance of proper voltage conditions upon the circuit, it would be necessary, would it, to correct the position of these levers, after they had once been shifted, by hand or otherwise?

A. It would, either to correct the position of these levers or to compensate for the error of their position, by manual or other means, in order to bring the apparatus to correct normal speed.

RDQ. 636. Then, if that is so, please state whether or not this dynamometer device, assuming it to be operative at all, could in itself perform proper governing action to maintain proper voltage conditions upon the circuit.

A. It certainly could not.

RDQ. 637. And as to such completeness of per-

formance of function, is or is not anything required in addition to the speed-sensitive device and its associated features in "Complainant's Exhibit A," the patent in suit?

A. No.

RDQ. 638. Please state to what extent sensitive-ness in governing action is a necessary condition in modern water-wheel governing in hydro-electric plants?

A. It is absolutely essential to satisfactory service from such plant for an automatic governor to be operatively incorporated therewith to maintain a constant speed of the prime movers. This, I believe, is true of every modern hydro-electric plant without exception, and the success with which the speed is maintained constant is a close measure of the satisfaction derived from the electric service supplied from such station. Roughly speaking, one percent variation in the speed of the apparatus will correspond with from five to ten per cent in the illumination of incandescent lamps. Rapid fluctuations of one per cent in speed in such apparatus will, therefore, result in the flickering of such lamps to an extremely disagreeable degree.

RDQ. 639. Are you able to mention or to refer to by general identification any more or less structurally complicated electro-mechanical structures or devices which have gone into and are in successful operation in both this art and other arts? If so, please refer to them.

A. In this art I call to mind large numbers of Replogle electrical governors, many of which I have built, installed, adjusted and operated, and which were satisfactory devices for accomplishing speed regulation of

water wheels in their day. They were somewhat crude, in that most of the modern governors contain more accurate elements for returning the speed to normal and for preventing the overrunning of the governor. But they accomplished their electrical and mechanical performance with satisfaction. The early electrical service in the San Gabriel Valley was largely under the control of electrical governors, and I believe the original Redlands plant was equipped with these governors. The service at Fresno of the early San Joaquin Development Company was under the control of electro-mechanical water-wheel governors, and the service was built up to a degree of great value during this period. The same sort of governor was used on a plant I recollect in Tuolumne County, California. The Utica mine, one of the largest mines in the world, of Angels, Calaveras County, California, was supplied by a plant from the town of Murphys and was, I believe, under the control of this kind of governor. Electro-mechanical governors were well known in the art as operative devices at the time of the Lyndon disclosure. Electro-mechanical devices in other arts are too well known to require any extensive description. The advertisement of modern railroads which we see so frequently headed as "Safety First," is largely based upon the block signal systems which are almost universally electro-mechanical, and their reliability and certainty of action is certainly beyond criticism.

RDQ. 640. Are so-called electric elevators both electro-mechanical or electro-magnetic and mechanical in their control?

A. They are electro-mechanical in the same sense that the Lyndon governor is an electro-mechanical device.

RDQ. 641. Referring now to "Defendant's Exhibit Wetmore Patent 519597," do you or do you not find disclosed therein any by-pass device for passing water around the wheel?

A. No such device is shown in this patent.

RDQ. 642. Is there therein disclosed any means or system capable of operating in such manner as to bring the water-wheel gate to its proper position subsequent to a change in load or speed of the water wheel, and to hold it there during completion of the governing action, so as to prevent overrunning of the water wheel?

A. No.

RDQ. 643. Then do you or do you not find disclosed in this Wetmore patent any means or system capable of performing the function of the returning device of "Complainant's Exhibit A," the patent in suit, including the clutch-discs "22" and "23", and the parts whereby the same are operatively connected with the remaining features of the governor, and are thrown into and out of operation?

A. There is nothing in this governor of the Wetmore patent intended to or that would perform the functions of the parts you have mentioned in the Lyndon patent.

RDQ. 644. In so far as the disclosure of this Wetmore patent goes, is it a possibly operative electro-mechanical water-wheel governor?

A. It is.

RDQ. 645. Is it electro-mechanical in its organiza-

tion and operation in the same sense, although not for the same purposes, as the disclosure of "Complainant's Exhibit A," the patent in suit?

A. It is.

RDQ. 646. Referring now to "Defendant's Exhibit C. S. English Patent 521085," do you find disclosed therein any by-pass device whatsoever for passing water around the water-wheel?

A. No, sir.

RDQ. 647. Do you find in this English patent any returning device for bringing the water-wheel gate to its proper position to conform with a change of speed or load of the water wheel and to hold it there during completion of the governing action to prevent overrunning of the governor?

A. No; no such parts or devices are disclosed in this English patent.

RDQ. 648. Do you or do you not, therefore, find disclosed in this English patent any features capable of performing the functions of the returning device disclosed in "Complainant's Exhibit A," including the clutch-discs "22" and "23" and the devices whereby the same are operatively connected with the other devices of the governor, and also the features for throwing the same into and out of operation?

A. I do not.

RDQ. 649. From the disclosure of this English patent is this English water-wheel governor a possibly operative electro-mechanical water-wheel governor in the same sense, although not for the same purpose, as

the disclosure of the patent in suit is an electro-mechanical water-wheel governor?

A. It is.

RDQ. 650. In the disclosed operation of each of these electro-mechanical water-wheel governors disclosed in the Wetmore and English patents just discussed, what will occur with respect to shifting of the water-wheel gate or gates responsive to governing action?

A. There will be an overrunning of the speed of the wheel controlled by either of these governors, and "hunting" by the governor, as a result thereof. This "hunting" will cause a surging up and down of the speed and of the voltage of the system.

RDQ. 651. And with what results, from a commercial standpoint?

A. The voltage surges will cause all the disastrous effects to the service previously testified to.

RDQ. 652. And with such a governor, built as each of these, applied to a water wheel in the attempt to regulate the same, what would occur with respect to inertia conditions in the pipe line or penstock upon opening and closing the water-wheel gates?

A. There would be great reductions and increases of pressure, the degree of which would depend upon the pipe line conditions, unless some other device were used in combination with the governor and as now known in the art, but at the time of the disclosure in these patents unknown.

RDQ. 653. Referring now to "Defendant's Exhibit Lamb Patent," do you or do you not find therein any

by-pass device for passing water around the water wheel?

A. I do not.

RDQ. 654. With respect to the supply of water to the wheel in accordance with the disclosure of this Lamb patent, what is the application of the supplied water?

A. It is applied tangentially through a number of nozzles to the buckets of the water wheel.

RDQ. 655. In what sense applied tangentially?

A. From a casing through nozzles tangential to the buckets.

RDQ. 656. How much of the water so supplied strikes the wheel?

A. In Fig. 1 of the patent, water is supplied through five of the six nozzles therein shown against the buckets of the wheel.

RDQ. 657. And through the other of the six nozzles?

A. The sixth nozzle is shown as an alternate nozzle to supply water in the opposite direction against the backs of the buckets, performing thereby a braking effect upon the speed of the wheel.

RDQ. 658. Then how much of the total water supply strikes the wheel, considered as a unit?

A. All of the water that may be flowing at any one time strikes the wheel either in one direction or the other.

RDQ. 659. And how much of the water supplied or controlled by this governor in any respect strikes the wheel?

A. All of the governor-controlled water strikes the wheel.

RDQ. 660. And in the use of the by-pass device what have you to say with respect to the extent to which all the water controlled by the governor strikes the wheel?

A. In the by-pass nozzle all that water corresponding with any reduction of load is cut off by the governor from the wheel, and some or all of it is diverted through a by-pass entirely independent of the wheel.

RDQ. 661. And is that equally true whether you have a by-pass nozzle or any other form of by-pass arrangement?

A. That is true generically of by-pass devices in the art.

RDQ. 662. In the use of a governor like that disclosed in the Lamb patent, is there or is there not any possibility of saving any water in connection with maintaining proper wheel speed, and at the same time preventing the undue action of inertia effects in the pipe line?

A. There is not.

RDQ. 663. In the use of such governor device as that of the Lamb patent is there any variation of the amount of water passed to the wheel, although the load on the wheel varies?

A. There is not.

RDQ. 664. What have you to say with respect to the governor of the patent in suit in these respects?

A. In the governor of the patent in suit with its associated by-pass device, upon action by the governor to

vary the water quantity impinging upon the water wheel, the change effected in the water quantity is reflected in a corresponding change in pipe-line velocity, accomplishing water economy through the slow closing action of the by-pass valve, if the valve be arranged for slow return to its normal position. If, on the other hand, the slow return to normal position is not used, the inertia effects are with equal degree prevented, but water economy would not then be accomplished. The slow closure to normal position is, I might say, used most frequently for water economy.

RDQ. 665. And in the use of the governor in the patent in suit is or is not the amount of water supplied to the wheel varied in accordance with the load imposed upon the wheel?

A. It is directly in proportion thereto.

RDQ. 666. And is there any such variation of the supply of water in connection with the Lamb patent governor?

A. No.

W. W. WILSON, heretofore sworn and examined on behalf of complainant, being recalled, in response to interrogatories propounded to him by Mr. Westall, testified as follows:

CROSS-EXAMINATION.

By Mr. Westall:

XQ. 91. Mr. Wilson, have you had an opportunity before being examined as a witness to examine "De-

fendant's Exhibit Berry Blueprint No. 1," which I now show you?

A. No, sir; I think the only time I have seen that was on direct examination.

XQ. 92. And you had not seen it before you were examined in your direct examination?

A. No, sir.

XQ. 93. Are you sure from the brief examination that you were able to make of the exhibit referred to, namely, "Defendant's Exhibit Berry Blueprint No. 1," that you understood the nature, objects and purposes of the different devices therein shown and illustrated?

A. The general principle of operation I understood. I do not know whether I went definitely into the action of the governor and those parts of it, or not.

XQ. 94. Did you read any of the testimony or did you have the substance of any of the testimony heretofore given in this case explained to you before you testified as a witness in this case?

A. No, sir.

XQ. 95. Had you been told in a general way what had been brought out by the examination of prior witnesses concerning the operation and construction of the water-wheel governor used at Bakersfield approximately in 1896 and 1897, known as the Girard governor?

Mr. Blakeslee: Objected to as indefinite and calling for a legal conclusion and not for a statement of facts, and that it is not the proper method of proof.

A. Mr. Henry and Mr. Blakeslee and I compared notes somewhat on that type of governing device. No instructions were given me on that matter outside of

comparing and sort of checking up what I knew about governing devices.

XQ. 96. By Mr. Westall: And what, if any, conversation did you have respecting the by-pass valve of the plug-cock type which you have testified concerning on your direct examination?

A. Mr. Henry, I believe, as shown in the direct examination, showed me some sketches which he had made up previous to the direct examination, which I looked over.

XQ. 97. Had you seen those sketches before you testified?

A. That day; yes.

XQ. 98. How much time did you spend in examining and comparing those sketches before you were called as a witness to testify?

A. About ten minutes, I suppose, would cover the entire time.

XQ. 99. And prior to that time had you compared those sketches with any of the exhibits in this case or copies of any of the exhibits illustrating any of the devices said to be used at Bakersfield in 1896 and 1897 by the Power Development Company?

A. No, sir.

XQ. 100. You had not compared any of those sketches prior to that time with "Defendant's Exhibit Berry Blueprint No. 1?"

A. No, sir. As I remember it now, the first time I saw "Berry Blueprint No. 1" was when it was shown to me in the direct examination.

XQ. 101. Since you have testified as a witness have

you been told what has been testified or what the substance of any testimony that has been given was regarding such Bakersfield devices referred to in my last question, and particularly the by-pass illustrated in "Defendant's Exhibit Berry Blueprint No. 1"?

A. No, sir; I don't think we have had any conversation at all since I testified.

XQ. 102. No conversation concerning any testimony which had been given by you, or any testimony which had been given?

A. No, sir; from the time I testified directly until the present.

XQ. 103. Do you understand fully the construction illustrated in "Defendant's Exhibit Berry Blueprint No. 1" at the points marked "41", "42", "43" and "49", and adjacent thereto?

A. Yes, sir.

XQ. 104. What do you understand is disclosed in the blueprint last referred to at the place I have indicated?

A. That is a rotating cylinder valve connected on one side with the water main and on the other side with the tailrace, and operated by the rotating cylinder to open or close the valve.

XQ. 105. Do you understand that the part marked "41" in "Defendant's Exhibit Berry Blueprint No. 1" is a cylindrical plug inside of the casing?

A. Yes, sir; with a hole through it. The part shown at "41" is a section of the cylinder through the hole.

XQ. 106. And do you understand what frictional contact there is between that plug and its casing, if any?

A. Frictional contact due to pressure of the head. That is, the difference of the pressure on the head side and the tail-race side of the valve to cause the plug to rest against the side of the cylinder in the casing.

XQ. 107. What do you understand to be disclosed by the dotted lines in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," and especially by the part which I have marked "A" in red on said exhibit.

Mr. Blakeslee: Objected to as not cross-examination, the witness manifestly showing by his testimony not to have made any further examination of the exhibit than a mere casual inspection of it during his direct examination, and as assuming that the indefinite dotted lines referred to are capable of interpretation to show anything positively and without extreme doubt and uncertainty; and calling for a conclusion on the part of the witness and not for a statement of facts, and not the proper method of proof, irrelevant, immaterial and incompetent.

A. It shows the casing surrounding the cylindrical valve in the by-pass.

XQ. 108. By Mr. Westall: How do you understand from those dotted lines that the plug within this casing is supported?

Mr. Blakeslee: The same objection.

A. It is controlled evidently from the shaft. I cannot say how the support is maintained. It is not shown at "41".

XQ. 109. By Mr. Westall: Would not the point that I have marked "A" indicate to your mind that a trunnion in a bearing supported one end of the plug,

and that the other side adjacent to figures "41" and "42" was supported by a bearing at that point?

Mr. Blakeslee: The same objection, and further that it is argumentative, not proper rebuttal cross-examination in any respect, this not being the time and place for the defendant to make out any part of its case from defendant's own evidence and exhibits.

A. The shaft controlling the cylinder evidently extended through into the casing at the side at "A", and I am unable to state whether any bearing is fitted there or whether it is on the edges of the cylinder, from the blueprint shown.

XQ. 110. By Mr. Westall: You would naturally infer from an examination of the figure to which I have referred, namely, Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," and the dotted lines showing this casing and by-pass valve, that this plug was either supported by a trunnion at the point which I have marked "A" in red on said drawing, or was supported by a shaft extending through the plug, would you not?

Mr. Blakeslee: The same objection, and as purely argumentative and a manifest attempt on the part of counsel to put words into the mouth of the witness, not calling for a statement of facts in any respect, and up^{on} each of the other grounds included in the last objection and repeated objection, and particularly this question does not call for a statement of facts but for a mere inference which manifestly is all that could be possibly drawn, and if so drawn would not be a statement of facts.

A. It all depends on the amount of clearance exist-

ing between the different parts of it, which I am unable to state, due to the inaccuracy of the drawing.

XQ. 111. By Mr. Westall: I do not believe that the witness has thoroughly understood the question, as the answer is clearly not responsive to it. I will therefore ask that the Examiner read the question, and that the witness again give it consideration.

Mr. Blakeslee: We object to this stringing out of the record by re-reading any such indefinite and purposeless questions, which, if it was not understood, was simply because there was no question at all capable of being answered by any statement of facts.

(The Examiner reads the question to the witness.)

A. That is owing to whether there is greater clearance between the cylinder and the shaft than between the shaft and the casing on the ends or not.

XQ. 112. By Mr. Westall: It is not a question whether the plug bears on the casing or on shafts, but whether you would infer from an examination of the parts of the drawing to which I have referred that either a trunnion or a shaft was extended through the plug, or for any reason whatever.

Mr. Blakeslee: The same objections, and all of them. It is manifest that this is merely an attempt of counsel for defendant to enlarge or modify the showing of the blueprint in question, which apparently he did not dare to do when he was examining his own witnesses, and the only inference to be drawn from such procedure is that he is taking a desperate chance at the present time which he was afraid to take when he was examining his own witnesses, and, therefore, the only possible testi-

mony that can be adduced from such examination would be open to the most radical criticism as to its accuracy due to the indefiniteness and lateness of the entire procedure.

Mr. Westall: We again call counsel's attention to the rule which prohibits argumentative objections, to-wit, Equity Rule 51.

Mr. Blakeslee: And we call counsel's attention to the fact that under the rule on which these proofs are being taken, witnesses are to be interrogated as to facts and are not to be argued with and coaxed to conform to the expressions of counsel which are merely argumentative assertions, and this whole line of procedure is manifestly not cross-examination or proper cross-examination of any kind, and the blueprint speaks for itself, and inferences and mere inferences may be made by counsel at the final hearing, but his inferences are not properly to be attempted to be used as the inference of the witness.

Mr. Westall: We admit that the blueprint speaks very largely for itself as to the particular point under examination.

A. I am unable to say whether the point "A" is at the center of the cylinder or above or below at the point shown. It may be an extension of the shaft or trunnion or it may be above or below, which would make it some point on the side of the valve casing.

XQ. 113. You will notice a vertical line drawn through the pipe "46" on Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," and you will notice that that vertical line is intersected at right angles by hori-

zontal lines which pass to the right of the pipe close to the figures "42". I will ask you to please examine those two lines and state whether or not this trunnion or extension of the shaft is not exactly opposite the operating shaft of the plug by-pass valve?

Mr. Blakeslee: Objected to as irrelevant, immaterial, incompetent, as the question cannot in any manner determine the horizontal plane of the axis of the plug-cock.

XQ. 114. By Mr. Westall: In other words, is not the horizontal line last referred to coincident, or intended to be coincident, with the axis of the shaft operating the plug within the casing?

Mr. Blakeslee: And further objected to as assuming that there is any shaft at all shown in this blueprint.

A. The only manner in which that could be determined is by another section, which is not shown, through the horizontal line through the plant "42". If a section was passed vertically through this line, by that means you could determine whether it was an extension of the shaft or trunnion or what its condition was.

XQ. 115. By Mr. Westall: You are satisfied that that was intended by the draughtsman to represent either an extension of the shaft or a trunnion supporting the plug within the casing, are you not?

Mr. Blakeslee: The same objection and as misleading, by directly contradicting one of the assumptions of the witness in these respects, and upon all the cumulated grounds of the objection last urged.

A. No; I am not able to state positively, due to the fact that I have seen mistakes made in that way before,

and the drawings are not shown with sufficient sections.

XQ. 116. By Mr. Westall: What would you infer or surmise would be the purpose and object of the construction attempted to be illustrated in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1" at the point I have marked "A" in red?

Mr. Blakeslee: The same objection, and also because counsel is descending further in the scale of proper examination of the witness to a point of mere surmise, which is too low beneath the level of any fact to produce any testimony which could be considered at all.

A. It might be a trunnion or it might be a lug at the side of the casing, and it might be a by-pass around the end of the cylinder. You cannot determine from the drawing at the point "A."

XQ. 117. By Mr. Westall: You say it might be a lug. Is there any indication upon "Defendant's Exhibit Berry Blueprint No. 1" in any place that a lug is used at that point for any purpose whatever?

Mr. Blakeslee: The same objections and all of them.

A. That is the only view of that particular section that is shown. The total of one part of the drawing is cut away in the section as shown in Fig. 4.

XQ. 118. By Mr. Westall: So far as you know, there is no reason why a lug would be needed at the point marked "A" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," is there?

Mr. Blakeslee: All of the same objections are repeated.

A. No, sir.

XQ. 119. By Mr. Westall: Then it would be rea-

sonable, would it not, to believe that the part marked "A" in Fig 2 of "Defendant's Exhibit Berry Blueprint No. 1" is either intended as a trunnion or is intended to show the end of the shaft "42"?

Mr. Blakeslee: All of the same objections, and further, that the witness's belief without any foundation for the belief other than as shown by the testimony, is absolutely immaterial.

A. It might be; yes. I am not willing to go on record as stating that that is what it is, because I don't know.

XQ. 120. By Mr. Westall: But you are willing to state that that is a fair, logical and reasonable conclusion from the examination of Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1," are you not?

Mr. Blakeslee: All of the same objections.

A. No. I don't know anything about that drawing outside of what it discloses, and it has not got the particular section to show what that is and I cannot state positively what it is.

XQ. 121. By Mr. Westall: I am not asking you to state positively, but I am asking you whether it would not be logical or reasonable to suppose that the point marked "A" in the figure referred to in "Defendant's Exhibit Berry Blueprint No. 1" is either a trunnion or the end of the shaft supporting the plug within the casing?

Mr. Blakeslee: All the same objections, and, furthermore, it makes no difference what is logical and reasonable. The witness testifies that he does not know what it is, and that is an end of the inquiry.

A. I would not say it would be.

XQ. 122. By Mr. Westall: Without stating that it would be, do you believe that it would be?

Mr. Blakeslee: The same objection, and furthermore, that the question has been answered again and again, and we object to stuffing the record with any such purposeless reiterative questions.

A. I am not willing to say. I know nothing about the design of that particular part of the machine.

XQ. 123. By Mr. Westall: Without knowing anything about the design of that particular part of the machine, I am asking you only to look at the drawing and from that superficial examination, without knowing more, to say whether it would not be entirely logical and reasonable to suppose that that was either the end of the shaft "42" or a trunnion?

Mr. Blakeslee: The same objection, and counsel by his question admits that knowledge by the witness has now been entirely eliminated from the inquiry, and, therefore, to answer the question cannot possibly be of any use in these proceedings, the witness having testified further to the best of his knowledge, judging from his inspection of this blueprint. Counsel is manifestly attempting to continue to testify himself without being sworn, and is making observations which can only be properly addressed to the court as being his own conclusions, guesses and hazards.

A. As I said, it may be or it may not be. I am not willing to say that it is a reasonable conclusion or not. It is owing to the complication of the machine and the purpose of it as to how many parts there might be there-

on, and as to whether that would be a shaft or trunnion or whether it was some other appendage on the side of the casing.

XQ. 124. By Mr. Westall: There being no reason for any other lug or appendage on this drawing, namely, "Defendant's Exhibit Berry Blueprint No. 1," so far as the construction thereof is concerned, it would be more reasonable, would it not, to suppose that the part which I have marked "A" in Fig. 2 of such exhibit is a trunnion or the end of the shaft than to suppose that it was a lug, would it not?

Mr. Blakeslee: The same objections, and all of them, and we move to tax the cost of taking and returning the cross-examination of this witness to the defendant, in all events, in view of our reiterated protest against this line of cross-examination and purposeless stuffing of the record that results therefrom.

Mr. Westall: We should like to have the record show that the witness has after each one of these questions concerning this particular point hesitated and has taken a long time to answer each question, showing that he is reluctant to testify concerning this point for some reason or other.

Mr. Blakeslee: We deny the statement. In point of fact, the witness, we assert, has not hesitated. He has taken possibly a reasonable time to frame his answer, and that can only be to the advantage of the defendant, particularly in view of the fact that the witness has testified that he has never made any full examination of this blueprint. If counsel wishes to make any such statement he should keep his watch out and make the record

show just what the delays are. We assert that the witness has not delayed his answers materially in any case.

A. I am unable and am unwilling to make any statements with regard to reasonable conclusions or anything of that sort. If I am confronted with a straight mechanical proposition I can answer it definitely and immediately. But I will go no further in regard to what this lug or point at "A" is, due to the fact that I do not know.

XQ. 125. By Mr. Westall: What do you understand is shown by the dotted rectangle in the center of the dotted portion of the drawing closely adjacent to the figures "43" in Fig. 2 of "Defendant's Exhibit Berry Blueprint No. 1?"

A. It is difficult to state what that is, due to the fact that it is probably an effort to show one of the ports either in the cylinder or casing, and there being several of these, it is difficult to say whether it is an effort to show a port or opening, or what it is. Parts of the blueprint are not complete with regard to the dotted lines or it would show all of the openings in both sides of the casing, as well as that in the valve.

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XQ. 126. You have stated in your direct testimony that there was in the Power Development Company plant at the time you were there no automatic device for regulating speed or maintaining constant speed of the water wheels or for preventing dangerous inertia effects to the pipe line. I will ask you why, if you know, were not some of the modern forms of automatic gover-

nors employed at the Power Development Company plant at that time?

Mr. Blakeslee: Objected to as placing an arbitrary construction on the testimony.

A. I believe I testified that there were certain devices there for the prevention of inertia effects in the pipe line, being the hydraulically operated relief valve outside of the plant, and the air cylinder. Otherwise there was no device. The question I had taken up several times with Mr. Dearth who was superintendent there, and under whom I was employed, and he said that a large number of devices and arrangements had been tried out on the plant and all proved unsuccessful to such an extent that he believed that there never would be a successful governing device for a hydro-electric plant, and consequently they did not have any device on the plant at that time.

XQ. 127. By Mr. Westall: Was your understanding of the sole reason that they were not equipped with any of the modern forms of governor that the company had become so disgusted in their efforts to get some form of governor, that they had ceased to make any efforts to get a governor?

Mr. Blakeslee: Objected to as calling for a conclusion of the witness, not a statement of facts, and not the proper method of proof.

A. That was the idea Mr. Dearth conveyed.

XQ. 128. By Mr. Westall: From your knowledge of water-wheel governing would you say that some form of automatic governing was needed as much at the plant of the Power Development Company at the mouth

of the Kern River Canyon near Bakersfield, about which you have testified, as at any other plant?

A. Yes, sir—no, not as much as in some cases, due to the fact that the plant was small and two men could cover the plant and handle it in most instances in case of sudden changes in load without serious interruption of the service at Bakersfield.

XQ. 129. And so you thought that the fact that the plant was small might have been one of the reasons why no automatic form of governor was used, and that that fact, also taken in conjunction with any possible discouragement which you speak of might have prevented the installation of a modern form of governor. Is that correct?

Mr. Blakeslee: The same objection.

A. The fact that the plant could be handled manually was its only reason for existence at the time I was there, because if it had been unable to be controlled through manual means the service it would render would have been such that they could not have used the hydro-electric system, and it would have been necessary to support a steam plant to supply Bakersfield with power and light. However, it was possible to control the plant under ordinary conditions by manual means, and, therefore, it was not absolutely necessary to the existence of the plant to place governors upon it.

XQ. 130. By Mr. Westall: So, if I understand you correctly, the only reasons that you can give for the failure to install some of the modern forms of governors in the plant of the Power Development Company near Bakersfield at the time you have testified to, was, first

that the management or owners had lost faith in governors as a whole, and, second, that there was not so much need in the plant for a governor because it was small and because the manually operated means were sufficient. Is that correct?

Mr. Blakeslee: The same objection.

A. I do not agree with the statement that manually operated means were sufficient. We were able by being absolutely on the job to manage the plant under the average circumstances. However, at times very bad service was rendered in Bakersfield, due to the fact that the load changes were beyond our control and it was necessary to shut down the plant and start over, seriously interrupting service at Bakersfield.

XQ. 131. By Mr. Westall: So the service at Bakersfield was not governed in any way except with these manual means. Is that correct, according to your understanding?

A. Yes, sir.

XQ. 132. And that if for any reason a man was not present to manually operate these manual means, poor service at Bakersfield would result. Is that correct?

A. Unless strict attention was paid to the plant at all times we were very liable to have very poor service in Bakersfield, due to the variations of load at the plant. And there were many conditions that might arise, for instance sticks blocking the nozzle of one of the exciters, would cause as serious a shut down as we could get.

XQ. 133. Did you ever have any such accident happen as you have just referred to?

A. Yes; about three times while I was on the plant.

XQ. 134. You say sticks coming into what part of the machinery?

A. Into the nozzle block in the water wheel supplying the field exciting generators. These nozzles, of course, were small, and a stick would plug that, which, of course, would reduce the voltage on the field circuit, and that would immediately take the load off of the big generators and allow the plant to run away unless it was shut down immediately.

XQ. 135. And with respect to the load variations on that Bakersfield plant, did they compare in their extreme fluctuations with those of other hydro-electric plants with which you have been acquainted? In other words, was there just as much need at that time by reason of the extreme fluctuations of load for an automatic form of governor as there is a hydro-electric plants generally?

A. No. This governing action was in a small part taken care of by the fly-wheel effect afforded by the fly-wheels on the shafts of the water wheel and generators. This fly-wheel afforded a time lag for any change in the speed of the machine sufficient to allow us to get to the controlling means and take care of it. That is, in case of a sudden overload we would be able to go to these wheels and open up more water onto the wheels before sufficient slowing had been effected to cause the generators to fall out of step; and in case of a decrease of load the fly-wheels would carry the speed of the generators so that we would be able to shut them down before a serious speed had been attained.

Mr. Blakeslee: We move to strike out the answer as

not responsive to the question, the question apparently calling for fluctuations of load upon the generators and extent of the variations.

XQ. 136. By Mr. Westall: Is it not a fact that the plant known as the Crane Valley plant and the Bakersfield steam plant is connected with the plant at the Power Development Company so that they work together synchronously, and that the Power Development Company plant about which you have testified had less need for an automatic governor because it was governed through one of these other plants with which it was working?

A. No, sir; at the time I was working at that plant the plant was not connected up synchronously with any other plant. The Bakersfield steam plant had not been erected at that time, and a small line was run up to the Edison Kern River plant, but this simply supplied power for crushers, till they got their plant in operation.

XQ. 137. Do you mean to say that there was no plant at that time that this plant, about which you have been testifying, was connected synchronously with or which assisted in its governing in any way?

A. Not generating plant.

XQ. 138. Any plant?

A. I testified that it was synchronously connected with a rotary converter which supplied direct current for an electric railway system and a synchronously motor for the flouring mill in the city of Bakersfield.

XQ. 139. It is usual, is it not, to provide some means for manually shutting off the flow of water to the water wheel or for manually operating the gates even in

plants where the most modern form of automatic governors are installed?

Mr. Blakeslee: Objected to as indefinite with respect to the use of the word "gates."

A. Yes, sir.

XQ. 140. By Mr. Westall: Can you give any reason why this manually operated means are provided even when the best forms of governors are used?

Mr. Blakeslee: The same objection.

A. So as to permit of starting and stopping of different generators as they are required on the line, and so as to permit shutting the water off so that nozzle blocks may be repaired or repairs of the wheel or wheel casing made.

XQ. 141. By Mr. Westall: Or in case of any breakage or failure of a governor to properly perform its functions, the water might be controlled by manual means? Is that true?

A. Yes; in the case of a failure of the governor it could be shut down by the gate valve.

XQ. 142. You have testified concerning a certain air chamber which you say was connected with the plant of the Power Development Company on the pipe line outside of the power house at the Power Development Company plant near Bakersfield. What did you understand to be the purpose and effect of such an air chamber?

A. This air chamber was kept filled with an air bubble whose elasticity would tend to absorb any of the smaller tendencies of the water in the pipe line to cause

a water hammer by any sudden change of the controlling gates at the water wheel.

XQ. 143. And this air chamber had no effect of any kind in governing the water wheel, but was simply there to protect the pipe line from dangerous effects of the water. Is that true?

Mr. Blakeslee: Objected to as calling for a conclusion and not for a statement of facts, not the proper method of proof.

A. I believe that is correct. I do not know of any action in governing that the air chamber could possible have performed. The only use for it that was ever explained to me or that I ever figured out was in regard to the inertia effect of the water column.

XQ. 144. By Mr. Westall: And such a device might properly be used on any plant, no matter what kind of a governor was employed if those installing the plant desired to have any additional protection to the pipe line. Is that correct?

A. Yes, sir; I think so.

XQ. 145. In other words, if the engineer having the designing or having in charge the installation of the machinery wished to adopt all possible means for protecting the pipe line, even with the installation of the best known modern form of governor, he might still use an air chamber connected to the pipeline in substantially the same manner and for the same purpose as that at Bakersfield. Is that not correct?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and not for a statement of

facts, and as merely argumentative and not the proper method of proof.

A. Yes, sir.

XQ. 146. By Mr. Westall: Now, at the time at which you were at the Power Development Company plant as testified by you on your direct examination, was that plant connected synchronously with any other plant to which it might be governed in any degree?

A. Not as far as speed or power generated are concerned, no. The only control we had was through the rotary converter and the synchronous motor at the flouring mill.

XQ. 147. And did not that fact make less needful an automatic form of governor, or, in other words, would that not be one of the factors that might enter into the decision of those in charge of the plant not to install any form of automatic governor?

Mr. Blakeslee: The same objection.

A. No, I cannot see how that could have any effect on the governor action of the plant so far as the speed and power developed is concerned. It simply had an effect upon the power factor. That is, bringing the pressure and current wave more in step in the transmission line and increasing the efficiency of transmission over the power line.

XQ. 148. By Mr. Westall: So you would say that that synchronous connection had no effect whatever in assisting in the regulation or governing of the plant. Is that true?

A. That is correct.

XQ. 149. In answer to question 67 you stated that

a butterfly valve was "more easy to control than any gate valve." What kind of valves did you have in mind when you used the term "gate valve?"

A. A valve in which a gate slides in a plane at right angles to the axis of movement of the fluid passing through the valve. In the common gate valve this slide rests against ribs on the seat.

XQ. 150. What is known as the "needle valve" is generally used in connection with water wheels at the present time, is it not, to control the flow of water to the wheel or through a relief nozzle?

A. I have seen the needle valve used in the controlling of water passing to the wheel. For instance, in the Edison plant on the Kern River above the Bakersfield plant.

XQ. 151. Two of such needle valves are illustrated in "Complainant's Exhibit Wilson Sketch A," and marked respectively "water gate" and "by-pass valve", are they not?

A. Yes, sir.

XQ. 152. Would you call such needle valves as referred to in your last answer "gate valves" in your answer to question 67 heretofore quoted?

A. No, sir; the movement in controlling in case of the needle valve is parallel to the axis of the movement of the water. In fact, it is co-incident.

XQ. 153. Would you call an ordinary plug-cock valve a "gate valve" within the meaning of your answer to said question 67 heretofore quoted?

A. No, sir. The action in opening or closing a plug-

cock valve is rotary and not longitudinally as in the gate valve.

XQ. 154. Referring to "Complainant's Exhibit Wilson Sketch C," please state whether you would consider the name "plug-cock valve" a proper descriptive term of the valve shown and marked "by-pass valve" in such drawing or sketch.

A. Yes, sir.

XQ. 155. Will you please describe this plug-cock valve illustrated in "Complainant's Exhibit Wilson Sketch C," describing particularly how it is supported within its casing and with what parts it comes in frictional contact?

A. This valve consists of a cylinder through which is an aperture in a diametral line. This cylinder is supported in a housing in which there is an opening to the cylinder and directly opposite an outlet from the cylinder, and in which opening or closing of the passage may be effected by rotating the cylinder so that its diametral opening registers with the casing openings, or it can be closed by so rotating the valve that the diametral opening is more or less at right angles to the casing opening. The cylinder bears against the sides of the casing surrounding it.

XQ. 156. Suppose that the plug-cock valve illustrated in "Complainant's Exhibit Wilson Sketch C" were not connected in any way with the water gate, but being substantially in the same location and for the same purpose, was operated manually independent of the water gates. Would you say that such a valve would perform its purpose and object any the less sufficiently

than a butterfly valve would in the same position and for the same purpose and connected and operated in the same manner?

Mr. Blakeslee: Objected to as indefinite in not stating how a butterfly valve was to be connected.

A. The butterfly valve would operate more easily than the plug-cock valve, on account of the fact that the water pressures are more balanced against the two opposite sides of the butterfly valve when in partially open positions than is the case on the plug-cock valve, and also the fact that the plug-cock valve bears against the sides of the walls of the casing, or causing a varying friction which increases as closure is effected.

XQ. 157. By Mr. Westall: So that the only reason why such a valve would be more difficult of operation, in your opinion, is that there would be more friction between the plug and its casing to be overcome. Is that correct?

A. No. That and the fact that in the case of the plug-cock valve there is only one stream of water passing through the valve and reactions against the valve are unbalanced, while in the case of the butterfly valve there are two streams of water pass the valve when in partially open position, whose reactions against the valve are balanced one against the other.

XQ. 158. And do you not think that any slight theoretical differences, is such exist, between the amount of friction or force necessary to operate the two valves, is a matter of very small consequence as a factor in determining the desirability of one valve over another?

Mr. Blakeslee: Objected to as placing an arbitrary

construction on the previous testimony of the witness and calling for a conclusion on the part of the witness and not for a statement of facts, not the proper method of proof, and being merely argumentative.

A. That is a matter which depends entirely on the head which is to be handled. In the case of low heads the reactions of the stream of water passing around a curved path are not serious. But as the head is increased the pressure exerted increases very much more rapidly, and the medium or high heads become a very important factor. The Bakersfield Power, Transit & Light plant had a head of about 220 feet, and the reactions on these streams were so great that we had a fire hose with a 1-inch nozzle that one man could hardly hold the nozzle when the full head of water was turned on.

XQ. 159. By Mr. Westall: Assuming that the plug in the by-pass valve illustrated in "Defendant's Exhibit Berry Blueprint No. 1" is supported by and rotates upon a shaft or at the point opposite its connection with its operating shaft, it is supported and rotates on a trunnion, and that the plug does not contact so as to cause any appreciable friction with its casing or housing, would you say that this valve would be any more difficult of operation than an ordinary butterfly valve located in the same position and for the same purpose?

Mr. Blakeslee: Objected to as not stating a mere hypothesis, but as being predicated upon conclusions with respect to the exhibit in question not borne out by the previous testimony of the witness or by the manifest disclosure of such exhibit, in that respect being misleading and placing an unwarranted interpretation upon the

exhibit in question, and as argumentative, without foundation, and calling for an impossible answer, and for these reasons not the proper method of proof.

A. Yes, sir; it would be more difficult of operation, depending on the power necessary to cause the stream passing through the by-pass valve to take a zig-zag course.

XQ. 160. By Mr. Westall: How much water is usually in the penstock or pipe line at the point just above the by-pass valve shown in "Defendant's Exhibit Berry Blueprint No. 1" in Fig. 4?

Mr. Blakeslee: Objected to as indefinite.

A. The pipe is full of water.

XQ. 161. By Mr. Westall: Suppose a butterfly valve placed in the by-pass illustrated in Fig 4 of "Defendant's Exhibit Berry Blueprint No. 1," and supported by a like shaft located in the same position as that shown in Figs. 2 and 4 of said "Defendant's Exhibit Berry Blueprint No. 1," please state whether or not it is a fact that if such butterfly valve is closed, it necessarily has to support on its bearings such weight or such water pressure as would the plug-cock valve disclosed in said exhibit?

Mr. Blakeslee: Objected to as assuming facts contrary to the testimony of the witness and the showing of the exhibit, with particular respect to the shafts mentioned, and calling for a conclusion.

A. Yes, sir.

XQ. 162. By Mr. Westall: And there would be absolutely no difference in the amount of friction it would be necessary to initially overcome between that

butterfly valve and a plug-cock valve constructed as I have before described, so that its plug does not come in frictional contact with its casing to any appreciable degree, and supported by a shaft or trunnion upon which it rotates?

A. That type of valve consisting of a cylinder supported on a trunnion is not a plug-cock valve, as I understand the term. The common illustration of a plug-cock valve is that used in a house hydrant in which the plug is slightly tapered and fits against the walls of the casing, the taper being for the purpose of taking up wear and keeping the valve tight.

XQ. 163. You can go on and answer the question.

Mr. Blakeslee: It is assumed that the question has been answered.

A. (Question having been read by the Examiner.) Not that I can see, in case of a cylindrical valve where the cylinder travels free of the casing.

XQ. 164. By Mr. Westall: And if a butterfly valve in the position and for the purpose described in the immediately preceding questions was closed, it would require just as great an amount of force for its initial movement as it would for the initial movement of the rotating valve heretofore referred to?

Mr. Blakeslee: The same objection.

A. The initial pressure, yes.

XQ. 165. By Mr. Westall: With a plug-cock valve or a rotating valve, whichever is the proper term, such as illustrated in "Defendant's Exhibit Berry Blueprint No. 1," or in "Complainant's Exhibit Wilson Sketch C," pivoted by a shaft or trunnions at opposite ends

and constructed so as to rotate on those pivots, there would be no reason why the body or cylindrical portion of the plug should contact closely with the housing or casing, would there?

Mr. Blakeslee: Objected to as stating and calling for a conclusion, as merely argumentative, not calling for a statement of facts and not the proper method of proof.

A. Yes; to cause complete closure it would be necessary to have the body of the valve contact with the case.

XQ. 166. By Mr. Westall. But complete closure would not be necessary for the purpose and in the position described, would it?

Mr. Blakeslee: The same objection; and further, that it is assuming a description that is forced.

A. A small opening would leave an opportunity for sand and sticks to clog the valve if it remained in that position long without movement.

XQ. 167. By Mr. Westall: And do those valves usually remain in closed position long without movement, or in any position long without movement?

Mr. Blakeslee: Objected to as assuming facts not testified to by the witness, namely, that there is any such thing as the hypothetical valve outlined by the previous question.

A. I do not know. I never observed a power house where a by-pass valve was used.

XQ. 168. By Mr. Westall: And there would be just as much opportunity for twigs, grass and other foreign matters, to clog and impede the operation of the butterfly valve, especially at points near its operating shaft or pivotal connection with the pipe in which it was placed, would there not?

A. Yes; but, however, it would not affect the rotation of the valve so much because you would have the greater leverage against its opening or closing.

XQ. 169. Now, a butterfly valve would not close the by-pass so as to prevent all leakage, would it? In other words, there would always be some space between the pipe in which the butterfly valve was placed and the periphery of the valve, would there not?

A. It would seem so, yes. However, the butterfly valves on the Kern River plant seemed to close the water column very completely.

XQ. 170. Now, in case the plug or cylinder of the rotating valve disclosed in "Defendant's Exhibit Berry Blueprint No. 1," assuming that such plug is supported by and rotates upon a shaft or trunnion, should be found to be difficult of operation because of any friction or contact with the casing, it would be a most obvious remedy to remove this plug or cylinder and grind it down so that it would contact very little, if at all, with its casing? Would it not?

Mr. Blakeslee: Objected to as merely argumentative and as based upon a false interpretation of the blueprint in question, and not calling for a statement of facts and not the proper method of proof.

A. Yes, sir; providing the shaft and trunnions were sufficiently strong to withstand the pressure exerted against the cylinder.

XQ. 171. By Mr. Westall: And if such trunnions or shafts were used at all, it would certainly be logical to make them strong enough to support the cylinder. Otherwise there would be no reason for their use. Is not that correct?

Mr. Blakeslee: The same objection.

A. No; they might be used for convenience in assembling or machining or for some other reason for fixing them there.

XQ. 172. By Mr. Westall: The ordinary damper in a stovepipe is a good example of a butterfly valve, or, rather, a good illustration of such a valve?

A. Yes, sir.

XQ. 173. If the disc of such a damper were made exactly the same size as the pipe it would be very difficult to turn, would it not, if not impossible to place it in the pipe?

A. That depends entirely upon the smoothness of the inside of the pipe and of the edge of the damper, and as to how much clearance there would be.

XQ. 174. Suppose that the disc would be so large that there was practically no clearance?

A. It could be lubricated and caused to move freely.

XQ. 175. If there was no clearance between the edge or periphery of such disc and the pipe in which it was placed, but if that was exactly the same size, or perhaps slightly larger than the pipe in which it was attempted to be operated, it would be very difficult of operation, wouldn't it?

A. Yes; if it was slightly larger it could not be placed inside of the pipe.

XQ. 176. The most obvious remedy for such a failure to operate would be to make the disc smaller, would it not, so that it would fit into the pipe?

A. Yes.

XQ. 177. And the most obvious remedy for a rotat-

ing valve in "Defendant's Exhibit Berry Blueprint No. 1" shown in the by-pass, if it were found by reason of friction to be difficult to operate, would be to remove the plug and grind it down, wouldn't it, in exactly the same way that one would grind down or reduce the size of the disc in a butterfly valve which was a little too large or which fitted too snugly in the pipe?

A. Yes; however, there is this difference: In the case of the plug valve it may or may not be necessary to construct the shaft passing through the same sufficiently large to withstand the pressure exerted against it. However, in the case of the butterfly valve, in order that the valve be workable at all, it is necessary to have the shaft constructed sufficiently strong to support the valve against pressure at part or full closure against the head of the water. For if this were not done the shaft would be sheared off and the valve blown out along with the water column.

XQ. 178. You have never seen a plug-cock or rotating valve such as is illustrated either in "Complainant's Exhibit Wilson Sketch 2," or in "Defendant's Exhibit Berry Blueprint No. 1," in actual operation in any by-pass, have you? That is, in any by-pass connected with any water-wheel installation, have you?

A. No, sir.

XQ. 179. So that your explanation of how this valve may operate or how it may not operate is based upon theory rather than any actual experience with such a valve used for such a purpose and in such a location as that shown in the exhibits referred to in my last question?

A. Yes; based upon the knowledge of moving water columns that I have gained in operating a hydro-electric station.

XQ. 180. But so far as that particular type of valve is concerned, namely, the rotating or plug-cock valve, you have never had occasion to see such a valve in operation with a by-pass for which it is evidently designed and shown in "Defendant's Exhibit Berry Blueprint No. 1." Is that correct?

A. Yes; that is correct.

XQ. 181. You have described that certain manually operated butterfly valve as having been in use at the plant of the Power, Transit & Light Company. Please state when you first observed that valve.

A. It was in April or May, 1906.

XQ. 182. How long before that had it been installed in the plant referred to, if you know?

A. I saw the general equipment for that plant the first time in the summer of 1904, and to the best of my knowledge and belief it was in the same shape then, as far as the valves and water-control is concerned, as it was in 1906 when I went to work at the plant.

XQ. 183. So that it must have been selected some time prior to 1904. Is that correct?

A. Yes.

XQ. 184. You were not present when it was selected or when its installation was proposed, were you?

A. No, sir.

XQ. 185. Then when you say in answer to question 67 that the butterfly valve was provided for use at this plant because it was more easy to control than any other

valve, you are not speaking with any positive knowledge of the reasons that operated upon the minds of those who selected it, are you?

Mr. Blakeslee: Objected to as not being according to the testimony of the witness, which was that the butterfly valve was provided, which is a very different thing from "chosen." "Provided," as we take it, means "put into place." To "choose" involves selection over others.

A. No, sir; I have no way of knowing that outside of the statements made to me by Mr. Dearth and Mr. Carpenter.

Mr. Westall: In view of the last answer of the witness, we move that all testimony regarding the probable reason for the selection of such valve be stricken out as resting entirely on hearsay.

Mr. Blakeslee: We oppose the motion on the ground that an engineer may testify as to the manifest reason for providing anything for any duty, when he knows the condition which surrounded the provision or condition which it had to satisfy in service.

XQ. 186. By Mr. Westall: For all you know, from your own knowledge, apart from any hearsay, this butterfly form of valve may have been selected because it was cheaper than some other valve or because it was more easy to install at that particular place, might it not?

A. That might have been the reason. However, I know that it was more easily operated, as well.

XQ. 187. When you say it was more easily operated, you mean it was more easily operated than the gate valve that you referred to, for instance?

A. Yes.

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XQ. 188. When you say in answer to question 81 that the water pressure causes the valve marked "by-pass valve" in "Complainant's Exhibit Wilson Sketch C," to be pressed against its seat, you are presuming, are you not, that the plug of said valve is in frictional contact with its casing and is not supported or rotated on a shaft or trunnion designed to bear the water pressure and designed to take such friction?

Mr. Blakeslee: Objected to as involving an unnecessary and pointless hypothesis, namely, that there are any such trunnions to be considered, inasmuch as the testimony of the witness has not disclosed the provision of any such device, nor has the witness testified to the presence of any such device, and is placing, therefore, an arbitrary and unfounded conclusion upon the testimony of the witness and the disclosure of these sketches.

A. It is my understanding that the plug-cock valve bears against the casing, and I answered that question with that in mind.

XQ. 189. By Mr. Westall: And you are assuming that the drawing marked "Complainant's Exhibit Wilson Sketch C," was intended to illustrate a frictional contact of the plug of the by-pass valve with its casing, and that such plug was not supported upon any shaft or trunnion designed to relieve or take away any friction of the plug with its casing. Is that correct?

Mr. Blakeslee: The same objection, and it is particularly pointed out that the testimony of the witness shows this to be a plug-cock valve, and further shows that in the light of his knowledge as to such valves and

plug-cock valves a plug-cock valve does not have any such bearing, he having distinctly testified to that effect.

A. Yes, sir; that was my understanding of the valve when I testified in regard to that sketch, and is still my understanding of a plug-cock valve, so far as any that I have ever seen.

XQ. 190. By Mr. Westall: Have you ever seen a by-pass valve of the plug-cock type either having its plug supported or rotated upon a shaft or trunnions, the plug having no frictional contact with its casing, or a rotating valve having a plug without such supporting shafts or trunnions and being supported and in frictional contact with its casing, either of such forms of valves being of approximately the same size as that illustrated in "Defendant's Exhibit Berry Blueprint No. 1" as controlling the by-pass and being used for the same or for any analagous purpose.

Mr. Blakeslee: Objected to as being merely repetitious, because it has already been answered by the witness, and, furthermore, as placing a conclusion upon the disclosure of the blueprint in question with respect to the dimensions of whatever that blueprint is supposed to represent, and as assuming without warrant that there is any by-pass disclosed by said blueprint, and upon the objections last made.

A. No, sir; I have never seen any by-pass of either type wherein this cylindrical type of valve was used. I have seen rotating valves of similar sizes with what I believe this represents in valves of Corliss engines.

XQ. 191. By Mr. Westall: When you speak of ro-

tating valves in connection with Corliss engines in your last answer, what kind of valves do you mean?

A. It consists of a cylinder with suitable ports through the same which are made to register with the openings in the valve casing by the rotation of the valve on its axis, which action is controlled by a stem and a bell-crank on the ends of the same and in which the valve bears against the casing around it.

XQ. 192. In which the plug bears against the casing?

A. Yes, sir.

XQ. 193. Do they use those valves at the present time?

A. Yes, sir.

XQ. 194. Are such valves difficult of operation?

A. Yes, they are; they require rather a heavy valve mechanism to control them.

XQ. 195. The butterfly valve is well known and has long been well known in the art, has it not?

A. Yes, sir.

XQ. 196. And is your testimony in relation to the valve illustrated in "Defendant's Exhibit Berry Blueprint No. 1" based, to any extent, upon your knowledge of this Corliss engine valve which you say is used at the present day?

A. Yes, sir. That is one of the types of valves which I have had experience with, of the plug-cock type.

XQ. 197. Do you mean to say that the Corliss engine about which you have spoken is an inoperative device on account of any friction between the plug and the cas-

ing of the valve and to which you have referred as being contained in this engine?

Mr. Blakeslee: Objected to as calling for a conclusion on the part of the witness and involving an arbitrary interpretation of the word "inoperative", and as not the proper method of proof.

A. No, sir; in my opinion the Corliss engine is a highly operative mechanism. This, of course, is due to the fact that these valves can be kept at all times perfectly lubricated and also has a very powerful mechanism to operate it.

XQ. 198. By Mr. Westall: You have referred to the devices illustrated in "Complainant's Exhibit Wilson's Sketch A" and "Wilson's Sketch B and C," as illustrating the "balanced valves." I will ask you to state briefly why the device shown in "Complainant's Exhibit Wilson's Sketch A" is, in your opinion, a balanced valve?

Mr. Blakeslee: The question is objected to inasmuch as it places a false interpretation upon the testimony of the witness with respect to the by-pass valve shown in "Complainant's Exhibit Wilson's Sketch C," which the witness has testified is not a balanced valve.

A. The needle valve shown in Sketch A is of a balanced type, due to the fact that at any positions except complete closure, the pressures due to the head of water causing the valve to open are balanced by the pressures causing it to close, and, consequently, the valve may be moved with freedom from the stresses of the head which it is controlling.

XQ. 199. By Mr. Westall: You have spoken of the device illustrated in "Complainant's Exhibit Wilson's

Sketch A'' as a "needle valve." It is a fact, is it not, that there are illustrated in this sketch two needle valves, one marked "water gate" and another marked "by-pass" valve? Is that not correct?

A. Yes, sir. However, I was speaking of the type of valve. Both are of the same type.

XQ. 200. When you stated that the device illustrated in "Complainant's Exhibit Wilson Sketch A'' is a balanced valve, which of these valves did you refer to? The one marked "water gate" or the one marked "by-pass" valve?

A. I referred to the needle type of valve, to which both of them belong. Consequently, I referred, really, to both valves; that is, both the by-pass valve and the water-gate valve.

XQ. 201. And you mean to say, then, that both of these valves are balanced valves; is that true?

A. Yes, sir.

XQ. 202. Now, it is true, is it not, that the only warrant you have for calling these two valves "balanced valves" is because they are joined together by a rod or link, and that upon the opening of one the other is closed, and vice versa, and they cannot be independently moved? Is that true?

A. No; I was thinking of a single needle-valve in regard to being a balanced valve, because in any position of pressure opening or closing, outside of complete closure, pressure of the head is balanced both on the back and front of the valve, and consequently it can be moved with comparative ease, friction excepted, in changing its position.

XQ. 203. Do you mean to say that a single needle-valve operated manually for controlling a by-pass valve and disconnected in any manner with the water gate, in other words, used as you have described in your testimony the use of the butterfly valve at the Power, Transit & Light Company plant at Bakersfield is a balanced valve?

Mr. Blakeslee: Objected to as indefinite.

A. Very nearly balanced. There is a slight difference in head due to the velocity action of the water passing around the valve. However, the valve is very nearly balanced.

XQ. 204. By Mr. Westall: Is it not a fact that the pressure of the water when the valve is closed or nearly so would prevent the valve from being moved backward in order to allow an opening? In other words, must not the complete weight of the pressure of water upon such a valve be overcome before such valve can be moved to open position?

Mr. Blakeslee: Objected to as indefinite.

A. As I stated above, the valve is not balanced when it is completely closed. It requires a certain pressure to start it to open position, but, as soon as a slight opening is effected, it then becomes balanced and the rest of the opening is a balanced action.

XQ. 205. By Mr. Westall: Will you please explain how when the valve is partly opened the water acts and assists in the further opening of the valve, and, therefore, makes this form of valve a balanced valve?

Mr. Blakeslee: All this line of questioning is objected to as not proper rebuttal cross-examination, and this ob-

jection applies to this whole line of testimony as so far developed, on the ground that the defendant's witnesses have testified uniformly with respect to the alleged bypass valve under consideration, namely, that attempted to be operated at the Power Development Company plant at the mouth of the Kern River as plug-cock valves, and the defendant is therefore estopped from showing what other types of valves might have been used or distinguishing between that valve and such other valves as might have been used, for the purpose of proving or disproving any of the issues of this case. This objection will be understood as repeated to any further questions along this line, which will, for that reason, needlessly encumber the record.

A. When the valve is partially open the needle part being completely submerged with water passing through the nozzle, and there being sufficient cross-sectional area between the outside of the needle valve itself and the nozzle casing, other than at the annular ring forming the nozzle, to permit a free flow of water, it is manifest that the entire needle valve head is subject to an equal pressure on all sides, and consequently the pressure from in front of the valve balances that in the rear, and there is no tendency to displace the valve.

XQ. 206. By Mr. Westall: Do you mean to say that the water pressing on the rear of the rounded portion of the head of the needle valve from the direction of the source of supply of the water is equal to the pressure from the front of the needle and pressing the needle backward toward the source of supply of the water?

A. Yes, sir.

XQ. 207. And that while water is escaping through this valve it presses equally backward upon the needle and that it presses with as much force backward upon the needle near its point as it does from behind the needle? Is that true?

A. Yes, sir.

XQ. 208. And is it also true, in your opinion, that the water presses back upon the needle after it has left the point of the nozzle?

A. Yes, sir. This is due to the fact that when the needle is properly designed, that is, the curve of reduction of the needle from the point of largest diameter forward in the stream is properly cleared, the reaction of the water flowing down over that curved surface is so designed as to balance any reduction of pressure from the point of the needle on forward.

XQ. 209. And that pressure upon the point of that needle is equal to the pressure from behind the needle?

Mr. Blakeslee: Objected to as indefinite.

A. Yes, sir.

XQ. 210. By Mr. Westall: Is it not a fact that there is more area of the needle back of its point of contact with the mouth of the nozzle than there is in front of this point?

Mr. Blakeslee: Objected to as indefinite and assuming that there is any single point of contact, and placing an arbitrary construction and an apparently incorrect interpretation upon the sketch in question.

A. Yes, sir. However, this is designed for the action of the water pressure.

XQ. 211. By Mr. Westall: Then, if that is true, in

order to compensate for the pressure upon the greater area at the rear of the needle, there must be a greater pressure backward of the water after it has left its nozzle, or while it is leaving its nozzle; is that true?—in order to compensate for the area at the rear of the nozzle?

A. No, sir. The pressure affecting the needle valve is that affecting the projected area taken along the axis of the stream of movement. That is, the pressure on that area of the needle beyond the point of largest diameter should equal that area on the projected area of the needle to the rear, which would be the same, with the exception of the area taken out by that of the stem diameter, which stem supports the needle. By increasing or decreasing the size of this stem a certain balance can always be effected. That is, a greater pressure can be made to come on the front of the valve than on the back by increasing the size of the stem where it passes out through the nozzle casing. For, supposing this stem was made equal to the largest diameter of the nozzle, the entire pressure on this valve would be backward.

XQ. 213. Then, in order to get the balance which you have spoken of, it would be necessary to increase the diameter of the stem upon which this needle is mounted, much larger proportionally than is shown in "Complainant's Exhibit Wilson Sketch A." Is that correct?

Mr. Blakeslee: Objected to as calling for a mere conclusion as to the degree and placing an arbitrary interpretation upon the disclosure of the sketch in question.

A. That is a matter of some refinement in design, and can only be calculated mathematically for the head,

the stem, the diameter in the opening and the amount of force required for the operation of the needle valve.

XQ. 213. By Mr. Westall: In order to obtain this balance in the needle valve illustrated by the portion marked "by-pass valve" in "Complainant's Exhibit Wilson's Sketch A," please state to what extent the water which has left the nozzle presses back upon the needle and aids in this balancing action. I mean to say, roughly, what proportion of this balancing is effected through the water which has left the nozzle.

Mr. Blakeslee: Objected to as calling for an arbitrary interpretation of the sketch and as also a conclusion as to matter of degree.

A. That is a very difficult thing to state offhand, because it can be made to vary to such a wide extent, in this way: the pressure depends upon the square of the velocity passing over the needle and upon the angle through which the water is caused to turn by the curve on the end of the needle valve. It is manifest that the velocity may be varied in different cases. That is, it is constant in any one case depending on the head of water to which the nozzle is subject. Also, the curve can be made to vary from any angle from 90 degrees down to almost zero.

XQ. 214. By Mr. Westall: Now, referring to "Complainant's Exhibit Wilson Sketch C," in which is attempted to be illustrated a plug-cock form of valve, which is marked on said exhibit "by-pass valve," is it your understanding that after the water passes through the port in the plug that it ~~passes~~^{re} back upon the plug in any manner and thereby balances the valve by a water pressure pressing back upon the plug?

A. Yes, sir. Of course, there is a certain reaction due to the nozzle form of the stream at this point. It certainly presses back with a certain amount of plain nozzle reactant pressure. However, as far as the pressure due to any curved action, as is effected in the needle valve, there is no such pressure in this case.

Mr. Westall: Cross-examination closed.

REDIRECT EXAMINATION.

By Mr. Blakeslee:

RDQ. 215. Now, as to the reaction of the water leaving a plug-cock, such as indicated in "Complainant's Exhibit Wilson Sketch C," and labeled "by-pass valve" that is, the reaction upon the plug-cock valve fitting in its case, how does such reaction compare in stress with respect to the stress of the water impinging upon the plug-cock valve on the up-stream side?

A. The pressure of the water applied to the plug-cock valve on the up-stream side would be theoretically that which applies over the surfaces exposed by the part in the casing where the water is admitted to the plug cock, and that on the down-stream side is in the opposite direction and is equal to the pressure head multiplied by the cross-sectional area of the opening through which the water is passing. The difference between these two pressures is the pressure with which the plug cock is pressing against its seat in the casing. Thus, it is seen that the pressure on the casing is maximum when the plug-cock valve is closed, and this is reduced to zero when the valve is open, provided the opening in the casing at the point of admission is equal to the opening

through the plug and to the opening at the discharge point at the plug valve into the casing.

RDQ. 216. Now, with the plug-cock valve in the position shown in this "Wilson Sketch C," and assuming you were attempting to initiate movement of the plug-cock valve, what water pressure would you have on the plug-cock valve with respect to maximum or minimum?

A. Maximum pressure.

RDQ. 217. And, therefore, an attempt to move this valve to open it would be attended, or would it not, by the maximum water pressure considering all of the water pressure applied to the valve at that time?

A. It would.

RDQ. 218. Now, referring to "Berry Blueprint No. 1" and assuming, as you have testified, that there was a head of over 220 feet, if I remember correctly, in the pipe line back of the attempted by-pass valve at the Power Development Company plant in which this by-pass valve is supposed to have been installed, substantially what would be the pressure upon this plug-cock valve "41" shown in Fig. 4 of this exhibit, opposing initial opening of the plug-cock valve and following the dimensions indicated in this blueprint and the relation between the axial dimension of this valve and its diametrical dimension as judged by the dotted line shown in Fig. 2 of this blueprint?

A. This pressure would be that pressure exerted by a water column 220 feet on each square inch of the casing at the lower end of the head, which is about 92 pounds to the square inch, multiplied by the opening area in square inches. So the opening area which is

closed by the valve above point "44" of Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" in square inches, multiplied by 92 pounds, will give the total pressure operating upon the valve.

RDQ. 219. Now, assuming that the area so acted upon was substantially 90 square inches. What would this pressure amount to in this valve?

A. 8280 pounds.

RDQ. 220. And in tons, how many?

A. About 4 1-8.

RDQ. 221. And can you say roughly what amount of force would be required to thus initially rock this plug-cock valve to bring it to a position of commencement of opening under such pressure, calculating by the showing in Fig. 4 of this blueprint and assuming that the part marked "40" connects with the crank-arm on the end of an operating shaft shown in dotted lines leading to the center indication "42".

A. This shows a length of operating arm equal to the radius of the cylinder of the plug-cock valve, and, therefore the pressure necessary to move the valve would be 8280 pounds multiplied by the coefficient of friction of the surfaces in contact. That is, the kind of metal or material the valve is composed of and that of the casing against which it rubs.

RDQ. 222. Do you know of any speed-sensitive governor device which, upon such calculations, would have a working capacity to rock such plug-cock valve under the conditions of pressure named so as to produce a sensitive response to governing action?

A. One could be constructed, of course, strong

enough to develop almost any power, provided it is constructed large enough.

RDQ. 223. And the larger you make such governor, is it true, or is it not, that you have a larger inertia factor which, in turn, affects the sensitive responsiveness of the governor itself to the governor mechanism?

A. Yes, sir; that is correct.

RDQ. 224. Now, with respect to the valve marked "by-pass valve" in "Complainant's Exhibit Wilson's Sketch B," is there any corresponding variation between maximum and minimum pressures of water upon this valve incident to the movement of the same?

A. Very little, if any. The actions are almost perfectly balanced in the butterfly valve.

RDQ. 225. And how in the same respects is it in consideration of the needle valve marked "water gate" and "by-pass valve" in "Complainant's Exhibit Wilson's Sketch A?"

A. If these valves are properly designed there is almost perfectly balanced action.

RDQ. 226. And is it proper to say that a plug-cock valve such as that shown in Fig. 4 of "Defendant's Exhibit Berry Blueprint No. 1" is "closed" in any position it assumes which interrupts theoretically or entirely the passage of water through the plug cock?

A. Yes, sir.

RDQ. 227. In the steam engine plug-cock valves you have spoken of, what have you to say in comparison of the ordinary steam pressure behind the same and the pressure upon the same type of valve of the same size incident to the application of a column of water with a head of over 220 feet?

A. The pressures usual in a Corliss engine are considerably in excess of that of a water head represented by 220 feet of water column. However, the opening of the valve is very much smaller, due to the fact that steam velocities are very much in excess of the velocity represented by water under the same pressure.

RDQ. 228. And what is the result of the effect on the balanced condition of the valve?

A. The size of the opening in the valve is very much smaller in handling steam than would be necessary for handling water power under similar conditions. The valve of the Corliss engine is still unbalanced. However, this valve is not used for governing; it is simply used for the purpose of admitting steam to the cylinder at the proper times, and also other valves are located below these cylinders for the purpose of permitting steam to pass out of the cylinders at the point of exhaustion.

RDQ. 229. Then, as I understand it, the tortion of the plug cock which is exposed to the steam pressure in its case is relatively small because of this relatively small port used in the plug cock?

A. Yes, sir.

RDQ. 230. And what is the result, therefore, as to the area exposed to pressure in a steam engine in comparison with the area exposed to pressure in a hydraulic plug cock such as disclosed in "Complainant's Exhibit Berry Blueprint No. 1" Fig. 4.

A. The area exposed to permit the passage of the same amount of power would be very much larger in the case of the water installation than in the case of the steam engine, due to the fact that the steam velocities

are very much higher than those of water under the same pressures, and, consequently, very much greater power will pass through an aperture of a given size for steam than for water.

RDQ. 231. And this steam at the same pressure as water in the same comparison, how will the total pressure upon the two valves opposing movement of the valves compare?

A. That depends upon the size of the valve.

RDQ. 232. Assume the valves were of the same size and consider the variation in superficial area of the valves upon which the steam and water respectively impinge, how will the pressures compare, namely, those which act upon the two valves, to oppose their turning?

A. The pressure exerted upon closing the valves and pressing against their seats would be the same. However, in the case of steam a much better lubrication is afforded, and, therefore, the coefficient of friction exists which allows a much smaller power to be used to move the valve in the case of steam than in the case of water.

RDQ. 233. Assume that less of the valve is exposed in steam powers than is exposed in water powers, what would be the relation of the pressures?

A. The variation in the pressure on a certain valve, providing the conditions remain the same, vary according to the area exposed. That is, the pressure reduces as the size of the valve is reduced.

RDQ. 234. Then if in two valves, one a steam valve and one a water valve of the plug-cock type, of the same size, there is less plug-cock area exposed for application of steam pressure than there is for the application

of water pressure, and the fluid pressures are the same, in which valve will there be the greatest total pressure opposing turning of the plug cock?

A. As I understand your question, the size refers to the horse-power transmitted through the valve ?

RDQ. 235. I am referring now to the size of the plug cock en mass.

A. Linear dimensions?

RDQ. 236. Yes. Diameter and axil length. I am referring to the size of the valves and supposing that they are of the same axil length and diameter.

A. The water valve.

RDQ. 237. And it is the practice in such steam valves to have relatively less of a valve surface exposed to the direct steam pressure?

A. Usually the valve is made smaller in linear dimensions.

RDQ. 238. And how does that affect the question of frictional existence?

A. The friction and resistance remain about the same, providing the area exposed to the pressure is the same.

RDQ. 239. But if the steam valve is made smaller relatively, what pressure change will there be if any?

A. There will be no pressure change provided the port area is left the same.

RDQ. 240. But if the port area is less than the port area in the hydraulic valve, how will the pressure compare?

A. The pressure will be very much less in the steam valve than in the hydraulic valve.

RDQ. 241. So that even if a greater steam pressure than water pressure is had, the proper passage of the steam might be effected with less pressure-producing friction in the steam valve than in the water valve. Is that correct?

A. Yes, providing the steam pressure is not very greatly in excess of the water pressure.

RDQ. 242. And in these steam valves is or is not considerable mechanical force required to actuate the same?

A. Yes; considerable force is necessary to operate the valve.

RDQ. 243. Now, in the installation of a plug-cock valve for hydraulic purposes such as that under discussion, and shown in "Berry Blueprint No. 1" Fig. 4, is it in usual practice, or any practice known to you, expedient to provide lubrication between the co-acting plug-cock and casing surfaces?

A. No, sir. The only means of lubrication possible in this case is to make the plug cock and casing of such material as will naturally lubricate themselves. Because any lubrication in the form of a separate lubricant applied to those parts would be immediately washed away by the water.

RDQ. 244. Therefore, how do the possibilities of lubricating such hydraulic plug-cock valve compare with the possibilities of lubricating such steam plug-cock valve as to efficiency or lubrication?

A. It is difficult to lubricate surfaces under water, while in the steam powers it is customary to apply the cylinder oil to the steam pipe passing to the plug-cock

valves in the cylinder, and, consequently, the steam carries the lubrication with it for lubricating the parts.

RDQ. 245. As to a body of predetermined shape or mass emersed in a stream, leaving out of consideration the frictional factor, what have you to say with respect to the comparison of the back pressure upon such body and the forward pressure thereupon?

A. If the area through which the stream passes around the body is sufficiently large so as to prevent serious pressure reduction on each side of the body, the only tendency to move that body is that of any friction of the fluid passing over the body.

RDQ. 246. And in needle valves of the type shown in "Complainant's Exhibit Sketch A," is it or is it not customary to take into account the conformation of the mass of the needle head in order to produce this balanced relation?

A. In the design of a needle valve it is almost necessary to take this factor into account and also all the other factors entering into any action upon the valve, because the design of a needle valve is one of a very delicate mathematical nature.

RDQ. 247. Now, is it possible to add to the diameter of the stem of a needle valve so that the back- or upstream pressure upon the needle valve is greater than the forward or down-stream pressure?

A. Yes, sir.

RDQ. 248. And by thus varying such stem dimensions is it or is it not possible to predetermine the status of balance of such needle valve?

A. It is.

RDQ. 249. Then your conception of the mechanical definition of a plug-cock valve, if such valve is not in intimate rubbing contact with its casing, is or is it not a plug-cock valve?

Mr. Westall: Objected to as having been fully covered, incompetent, irrelevant and immaterial, and not proper redirect examination.

A. So far as I can remember, the only types of plug-cock valve that I know of have a plug in intimate contact with the casing.

RDQ. 250. By Mr. Blakeslee: And, therefore, if the plug is not in intimate contact with the casing and is carried on end bearings, is it or not a plug-cock valve?

A. I should say that it was not a plug-cock valve.

RDQ. 251. Now, as ~~between~~^{for} two plug-cock valves of the same capacity, one ~~of~~ steam practice and the other for water practice, which, if either, would be subjected to the greater frictional resistance to rotation?

A. The valve whose product of pressure and coefficient of friction is the greatest would have the greatest frictional resistance.

RDQ. 252. And how would that work out as between the two such plug-cock valves of the same capacity of pressure fluid to control?

A. The frictional resistance would be much greater in the case of the hydraulic valve.

RDQ. 253. If a rotating valve mounted in its case so that it has its contact within the case, and an interspace exists between it and its case, what have you to say with respect to any tendency of the valve to sub-

clear or clean itself of grass, twigs, or other inter-lodging obstructions, in comparison with the same qualities of a butterfly valve?

Mr. Westall: The same objection.

A. The cylindrical type of valve mentioned in the question would not clear itself of obstructing particles or material as would the butterfly valve, due to the fact that the surface exposed to the cylindrical valve has more of a tendency to grind the particles of material back and forth without clearing the confined space, while in the butterfly valve this condition exists only at a very small point or area adjacent to the axis of rotation.

RDQ. 254. By Mr. Blakeslee: In your previous testimony, under cross-examination, when you referred to a "gate valve," in what sense did you mean us to understand your use of the term? Or give us a definition of your conception of a gate valve as such.

A. The term "gate valve" is applied to that type of valve wherein a disc or plane surface is slid in the plane perpendicular to axis of movement of the fluid controlled.

RDQ. 255. Referring to the air chamber which you have mentioned as being on the pipe line of the Power Transit & Light Company plant, or Power Development Company plant, outside of the power house, what was the action of the air bubble in the same after it had once yielded to a shock of inertia effect in the pipe line?

A. In the case of a shock in the pipe line caused from a sudden closure or partial closure of the water nozzle, the bubble is compressed; as soon as the shock is absorbed, that is, if the shock comes within the range of

the air cylinder, the increased pressure causes a retardation slightly of the velocity of the entire water column, slightly in excess of that necessary to maintain the pressure at the lower end of the pipe, and on the air bubble, with the opening at that time exposed in the way of the nozzle. Its deficiency of water is then supplied by the expansion of the air bubble until it gradually regains its original size. Or it may go beyond this point slightly and drop back and forth until an equilibrium was again established.

RDQ. 256. Does this air bubble in this air chamber, therefore, prevent inertia stresses in the pipe line or penstock, or merely act in an alleviating nature with respect to the same when produced?

A. The air bubble reduces the range of pressure affecting the pipe line which would be caused by any given shock under that which would exist were the air bubble not present.

RDQ. 257. Is it or is it not necessary for the shock in the pipe line first to occur before the air bubble in the air chamber can act to affect the same?

A. It is necessary to have a shock in the pipe line in order to bring the air bubble into action.

RDQ. 258. Now, in the use of a positive vent upon the pipe line to permit actual escape of water when any tendency toward shock-production in the pipe line occurs, is it or is it not possible by the provision of such vent, such as that controlled by a by-pass, to prevent such shock?

A. The usual cause of shock in a pipe line is due to the more or less sudden opening or closing of the nozzle

area. The effect of a by-pass when properly constructed and designed is to be able to keep this nozzle area constant for the entire lower end of the pipe line. That is in case of a reduction in power by governor action closing the nozzle wherein the water is applied to the wheel, a corresponding increase in the opening of the by-pass maintaining the total nozzle area constant will avoid tendency to shock the pipe line.

RDQ. 259. Then do I or do I not understand you correctly when I deduce from your testimony that in the use of the air-chamber and the air-bubble a shock first occurs in the pipe line and then is attempted to be modified by the air bubble, whereas in the use of the by-pass device a shock is anticipated or prevented?

A. That is my understanding of it; yes, sir.

RDQ. 260. And in the use of such an air bubble, is there or is there not always a rebound with a succeeding shock in the pipe line?

A. Yes; to a smaller degree than the original shock there is a rebound. In cases of rather severe shock, there is a series of these gradually diminishing shocks.

RDQ. 261. Now, with respect to even inexpensive and satisfactory governing, what have you to say with respect to the results obtained at the Power Development Company's plant, incident to hand governing, when you were there, in comparison with the results which might have been obtained at that plant had a modern automatic governor been employed?

A. If a modern automatic governor had been employed the services of three men might have been dispensed with, because it would have been very easy for

one man to control the entire plant without any of the assistants.

RDQ. 262. And how with respect to even and satisfactory governing?

A. The governing also would have been much more even and more satisfactory in the case of the automatic governor.

RDQ. 263. Were or were there not fluctuations of the load imposed upon the water wheels at this plant while you were there, which in central-station terms are proper to state as being great fluctuations?

Mr. Westall: Objected to as vague and indefinite.

A. There were great fluctuations imposed at times. However, it was rare in this plant. These fluctuations were due to the breaking of wires and breaking down of insulators and short-circuits on the line. As far as general load conditions were concerned, about the only fluctuation we noticed in the power outside of the gradual increase and decrease of the load at different times of the day, was due to the street car service in the city of Bakersfield.

RDQ. 264. By Mr. Blakeslee: A fluctuation in load due to street car service required, did it, or did it not, frequent repetitious hand governing of the plant?

A. No. We usually let the wheels take care of themselves, and the voltage and frequently varied as much as eight or ten per cent.

RDQ. 265. And how does such variation of voltage affect incandescent lamps installed upon such a circuit?

A. It is noticeable in the brilliancy of incandescent lights.

RDQ. 266. What effects are produced in this brilliancy?

A. Causing an increase or decrease in the brilliancy of the lights, due to variation in voltage.

RDQ. 267. Is such fluctuation or flickering of illumination of incandescent lamps considered a proper condition at the present day with modern governing apparatus controlling the generators?

A. It is desirable, of course, to avoid any flickering of the lights, if possible; and it is usually taken care of with the modern governors, and the size of the apparatus furnishing the power, together with the wires carrying the current to the point of consumption. So that in a well regulated plant no flickering can be observed.

RDQ. 268. Then the governing of that plant would not today be considered proper governing in these respects. Is that so, or is it not?

A. I think the service which was furnished by the Power, Transit & Light Company power house at that time would today be considered very poor. In fact, it was considered so at the time I was operating on the plant, particularly in the summer time when the amount of current consumed in lighting was small as compared with the motor load. The variation was quite noticeable.

RDQ. 269. That is, poor with respect to governing?

A. Yes, sir.

RDQ. 270. And would that governing likewise be today considered poor if there were other energy-consumers upon the circuit supplied with energy at that

plant which required evenness of voltage to maintain constant speed or constant performance of one nature or another?

A. In case of any such apparatus it would be necessary to put a voltage-regulator on the line supplying the particular piece of apparatus, in order to get a steady voltage.

RDQ. 271. And governing considered proper at the present time would obviate the necessity of such voltage-regulator, would it?

A. Yes, sir.

RDQ. 272. Referring to "Defendant's Exhibit Berry Blueprint No. 1," do you find any lengthwise or axial shaft of the plug-cock valve "41" indicated in the sectional view of Fig. 4?

A. No, sir.

RDQ. 273. If that were a true section transversely to the plug cock, would or would not such shaft show in section in this view?

A. The shaft would show in full line across that section in the view.

RDQ. 274. Referring to "Defendant's Exhibit XX," and to the parts generally designated as "J" therein, do you find any indication of any end bearing on any rotating valve included in those parts shown at the left-hand side of such parts "J"?

A. No, sir.

RDQ. 275. Referring to "Defendant's Exhibit Cobb Blueprint No. 1," do you find therein in the part marked "J" any indication of any axial shaft or of any end-bearing at the end of the part "J" opposite to that which is provided in the feature marked "K"?

A. No, sir.

RDQ. 276. Referring to "Defendant's Exhibit Berry Blueprint No. 1," and assuming that in Fig 2 the dotted line next to the figures "43" and the other dotted line beneath the same and next parallel to it, indicate the port through the plug cock, and do you find any indication of any axial shaft in such showing?

A. No, sir.

RDQ. 277. Referring to "Defendant's Exhibit Cobb Blueprint No. 1," do you find any indication shown in the part "J" thereof of any such axial shaft?

A. No, sir.

RDQ. 278. When you have stated that the nozzle block of the exciter water wheel of this Power, Transit & Light Company plant became plugged by any small stick or any small twigs or grass, or any other obstruction, was any inertia effect produced in the pipe line or penstock?

A. No, not noticeably, due to the fact that this nozzle was very small, being not more than an inch or an inch and a quarter in diameter, whereas the wheels are provided with nozzles of about 144 square inches nozzle area in the wheel, there being three of them, and there would be about 432 square inches if the plant is running to full capacity.

Mr. Blakeslee: That is all.

Mr. Westall: No recross.

July 8, 1915, P. M .

C. L. Cory, a witness heretofore produced and sworn on behalf of complainant, being recalled for further

testimony on behalf of complainant, testified as follows
in answer to questions by Mr. Blakeslee:

BY MR. BLAKESLEE:

Q. 531. You are the witness Cory who has previously testified for complainant in this case, are you not?

A. Yes, sir.

Q. 532. I believe you have previously testified in this case that you have familiarized yourself with the drawings, specifications and complete disclosures of Complainant's Exhibit A, being a copy of the Lyndon patent in suit; is that correct?

A. Yes, sir.

Q. 533. In your previous testimony you have discussed certain elements of a disclosure in said Lyndon patent referred to as the by-pass and by-pass valve therefor, and means for causing the by-pass valve to return to a certain position after it has moved in conjunction with the water-wheel gate inversely thereto. I will now ask you if you have familiarized yourself with "Defendant's Exhibit C. S. English Patent No. 521,088", which I now hand you?

A. Yes, sir, I have, and I believe that I understand it.

Q. 534. Do you or do you not find in the disclosures of the English patent the several features and elements which I mentioned in my last question?

A. No, I do not find the same elements.

Q. 535. Do you find any elements in any sense equivalent thereto?

A. No, I do not.

Q. 536. Have you familiarized yourself with the dis-

further direct examination.

closures of "Defendant's Exhibit Wetmore Patent No. 519,597", which I now hand you?

MR. WESTALL: It is to be noted of record that in answering these questions the witness has before him a chart of some kind, to which he refers before making answer, and counsel for defendant objects to the use of any such chart unless it is identified and offered in evidence.

MR. BLAKESLEE: We do not believe the witness is depending upon any chart, whatever it may be, before him, and therefore we will ask the witness to answer the question without reference to any such chart.

THE WITNESS: Before answering the question, I desire to say that I am not, nor is it my intention, to utilize the chart in any way whatsoever in answering the question.

(The reporter here read Question No. 536.)

A. I have.

Q. 537. Do you find disclosed in that patent the particular features and elements which I have last referred to?

A. I do not.

Q. 538. Do you find disclosed in that patent anything in any sense the equivalent of any such element referred to?

A. I do not.

Q. 539. Have you familiarized yourself with the disclosures of Defendant's Exhibit Lombard Patent, No. 533,656, which I now hand you?

A. I have.

Q. 540. Do you find disclosed in that patent any by-pass device and valve therefor for passing around a

water-wheel any part of the water which otherwise would flow to the wheel, such by-pass being connected with a water-wheel gate and operated inversely thereto?

A. I do not.

Q. 541. Do you find anything in any sense equivalent to any such by-pass device and valve therefor?

A. No, sir, I do not.

Q. 542. I now show you Defendant's Exhibit Lamb patent, and ask you if you are familiar with the disclosures thereof?

A. I am familiar with the disclosures of the Lamb patent.

Q. 543. Do you find disclosed in any manner or place in that patent a by-pass device for passing around the wheel, so as not to engage the wheel, any portion of the water which otherwise would be passing to the wheel, with a valve device for such by-pass device?

A. I do not.

Q. 544. In your previous testimony you have discussed certain features of Complainant's Exhibit A (copy of Lyndon patent in suit), therein referred to as the returning device, and including the clutch members 22 and 23, the electro-magnet, 32 for operating the lever arm 24, to cause such clutch members to coengage, and the several connections between the clutch member 22 and the core 34 of the solenoid 33. Will you please now briefly state what effect the operation of this returning device has upon the change of position or condition of the water wheel gate or gates, in the operation of the governor?

A. I don't know that I am absolutely clear as to what

you mean by the general statement, the operation of the governor.

Q. 545. Well, kindly answer the question which is put, with the explanation which I now give, that by operation of the governor I mean the general performance of the governor apparatus disclosed in the patent in suit. What I wish to know is what part this returning device plays in the general operation of the governor and the movement of the water wheel gate or gates?

A. Well, the part played by the returning device in the operation of the governor upon the water-wheel gate is to prevent the water-wheel gate closing so rapidly as to overrun, or to cause what is generally known as hunting for the governor and a speed above, and then a speed below normal.

Q. 546. In this connection how with respect to the opening movement of the water-wheel gate?

A. The same is the effect of the returning device, preventing the opening of the water-wheel gate to proceed farther than is absolutely necessary for the changed conditions, and necessitates its being, after it has been opened, closed slightly to meet a balanced set of conditions.

Q. 547. In other words, how would you define the position to which the water-wheel gate is caused to be brought through the agency of this returning device?

A. The position that the water-wheel gate is brought to is its final and definite position for that particular condition of load.

Q. 548. Do I understand that you limit your observation to changes in load?

A. Changes in load, or a change of speed for any reason.

Q. 549. I now call your attention again to Defendant's Exhibit Lamb patent, and ask you if you find disclosed therein any agency, device or element which corresponds, in either construction or function, with this returning device of the Lyndon patent in suit, which we have just discussed?

A. No, I do not.

Q. 550. Do you find any element, device or agency disclosed in this Lamb patent, which in any sense is equivalent to such returning device?

A. I do not.

Q. 551. Similarly I call your attention to Defendant's Exhibit Wetmore patent, No. 519597 and ask you if you find disclosed therein any agency, element or device corresponding, in either construction or function, or performance, to this returning device of the Lyndon patent which we are discussing?

A. No, sir, I do not; no such device, or the equivalent thereof.

Q. 552. Similarly I call your attention to Defendant's Exhibit C. S. English patent, No. 521,085, and ask you if you find disclosed therein any agency, element or device corresponding, in either construction or function, to this returning device of the Lyndon patent which we are now discussing, or in any sense equivalent thereto?

A. I do not.

Q. 553. Similarly, I call your attention to Defendant's Exhibit Lombard Patent, No. 533656, and ask if you find therein any agency, element or device corre-

sponding, in either construction or function, with, or in any sense equivalent to, this returning device of the Lyndon patent which we are discussing?

A. No, sir, I do not.

Q. 554. I now call your attention to Defendant's Exhibit French Patent, and ask you if you have familiarized yourself with the disclosures thereof?

A. Yes, sir, I have.

Q. 555. Please state whether or not you find disclosed in Defendant's Exhibit French Patent any device, element or agency corresponding in either construction or function with or in any sense equivalent to this returning device of the Lyndon patent which we are discussing?

A. I do not.

Q. 556. Similarly I call your attention to Defendant's Exhibit Swiss Patent, and ask you if you have familiarized yourself with the disclosures thereof?

A. Yes, sir, I have.

Q. 557. Please state whether or not you find disclosed therein any device, agency or element corresponding in either construction or function with, or in any sense equivalent to this returning device of the Lyndon patent in suit which we have been discussing?

A. I do not.

Q. 558. I now show you Defendant's Exhibit Nozzle and Governor for North Star Mines, Grass Valley, California, September 3, 1898; Sheet 27, and ask you if you have familiarized yourself with the showing of this blueprint?

A. Yes, sir, I have.

Q. 559. Do you find disclosed in this blueprint any by-pass device, or any valve for such by-pass device, such as we have discussed ^{as in the Lyndon} in the Lyndon patent in suit, or any thing in anywise equivalent thereto?

A. I do not.

Q. 560. Furthermore, do you or do you not find disclosed in this blueprint any returning device such as disclosed in the Lyndon patent in suit, or anything in any wise equivalent thereto?

A. I do not.

Q. 561. I now call your attention to Defendant's Exhibit Berry Blueprint No. 1, and ask you if you have familiarized yourself with the disclosures thereof?

A. I have.

Q. 562. Do you find disclosed in this blueprint any device, agency or element which corresponds in either construction or function with, or in any sense is equivalent to the returning device of the Lyndon patent in suit which we have been discussing?

A. I do not.

Q. 563. Referring still further to this ^{present} patent blueprint, what is your understanding of the parts associated together in the blueprint and lettered 40, 41, 42, 43, 44 and 46?

A. My understanding of the parts mentioned in the question is that these parts taken together compose an operating mechanism for a rotating stopcock valve which may have its position changed to allow water to be by-passed around the water wheel itself; the position of this rotating stop-cock valve being dependent upon the operation of the crank shaft 49 connected with the con-

necting rod 40; this rotating stop-cock valve being mounted on a shaft 42 and supported upon one end by the bearing 41.

Q. 564. Does the part you refer to as the shaft 42 extend through the stop-cock you have referred to?

A. From the drawing I would infer that the shaft does extend through the rotating stop-cock valve, but having a bearing only upon one end.

565. Is this shaft shown in Figure 4 of this blueprint?

A. It is.

Q. 566. What nature of view do you make out this figure 4 to be, with respect to the stop-cock?

A. It is a sectional view.

Q. 567. Is the shaft you have referred to a sectional view?

A. It is not; it is shown dotted, or appearing behind the sectional view of the rotating stopcock valve.

Q. 568. Is it then indicated as passing through the stopcock valve, in this view?

A. No, it is not so indicated in view figure 4.

Q. 569. Please define a stop-cock valve as you have used the phrase?

A. The use of the adjective "stop-cock" is properly applied to this valve, as it is exactly similar to the so-called water-cock, or stop-cock, wherein a cylindrical valve, through which a hole is cut, is inserted concentric with the outer casing of the valve; the opening of closing of the valve being accomplished by rotating the inner portion of the valve closing it, and when the metal part of the internal cylinder closes the openings, and open-

ing the valve when the hole cuts through the stop-cock shaft is moved so as to make a free passage through the valve casing itself.

Q. 570. I notice that you have referred to a hole cut through the stop-cock shaft. Do you refer to the hole shown cut through the stop-cock body in figure 4?

A. Yes.

Q. 571. What is the nature of the engagement of the stop-cock body with the casing or housing within which it is turned?

A. Well, the stop-cock shaft, as I have used it, is inserted within the cylindrical casing of the valve, and the engagement is which might be called the fitting of the shaft part of the stop-cock valve into the concentric exterior casing.

Q. 572. Am I to understand, or am I not, that this stop-cock body, or shaft as you call it, turns in the casing?

A. Yes.

Q. 573. Slipped around it?

A. It must turn in the casing in order to be opened or closed, or increase the opening, or decrease the opening.

Q. 574. Do you find disclosed in this blueprint any other shaft than the body of the stop-cock to which you have referred, and pertaining to the mounting of this stop-cock?

A. I observe the shaft which carries the stop-cock body, which I think is a better word than stop-cock shaft, 42, in figure 4, and also 42 in figure 1.

Q. 575. By what means is the stop-cock body rotated?

A. The stop-cock body is rotated through the connecting rod 40 acting upon the crank shaft 49, outside of the valve casing.

Q. 576. Is that crank shaft, or is it not, the shaft you have referred to at the end of the stop-cock body?

A. It may be a part of the crank shaft, or it may be a part of the shaft upon which the stop-cock valve body is mounted it is not clear from the drawing, which.

Q. 577. By what is the frictional pressure of the turning stop-cock taken up in this blueprint disclosure?

A. There is nothing on the blueprint to indicate any method of compensating for the friction.

Q. 578. Between what parts does this friction exist?

A. The friction exists between the stop-cock body 41 and the casing 43.

Q. 579. Is there such a valve known to engineering as a plug-cock valve?

A. Yes, I think so.

Q. 580. How does that compare with the stop-cock valve you have testified about?

A. It is very similar to it in construction and operation.

Q. 581. Can you point out any difference?

A. The only difference that I can think of would be probably in the plug rotating valve that the rotating element would be tapered so that it might be tightened up by a screw on the lower side, and the wear taken up in that manner.

Q. 582. Is there, or is there not any difference between the plug-cock valve and the stop-cock valve with

respect to the frictional engagement of the body of the valve with the casing within which it turns?

A. No, there is none.

Q. 583. Does or does not this frictional engagement always occur in these types of valve?

A. The frictional engagement between the rotating element on the inside and the casing of the valve on the outside always exists in valves of this type.

Q. 584. I call your attention to what appears as a dotted line enlargement in Figure 2 of this blueprint before us, marked with the red letter and leading line A, and ask you if you find any indication of any such part or showing in Defendant's Exhibit XX, which I now put before you, in the part marked "J" therein?

A. No, I do not find any such on the part marked "J".

Q. 585. Do you or do you not find any indication from this blueprint before us of any of the friction existing between the stop-cock valve and its case being in any way compensated for by the shaft 42, or crank shaft from which extends the crank 49 and connecting rod 40?

A. No, I do not find any such.

Q. 586. Do you find in this blueprint before us any indication of any definite bearing or journal for such crank shaft or shaft 42?

A. No, sir, I do not.

Q. 587. Do you in this blueprint find any indication or disclosure of any adjunct or part for attachment of the plug-cock valve designed to take from or share with the plug-cock the frictional strain or resistance set up by engagement of the plug-cock with its case in rotation of the plug-cock?

A. No, sir, I do not.

Q. *M* Assuming water flowing through the pipe 46 to exert the pressure of the head in that pipe upon the plug-cock 41, what would be the effect of such pressure upon the turning of attempted turning of that plug-cock, responsive to any governing action, assuming that the blueprint discloses a water wheel to which water is supplied through the pipe 46?

A. The effect of the pressure in the pipe 46 would be to increase the friction between the stopcock body and its containing case, the friction increasing as the pressure increases. By "friction" I refer to the friction which would resist or retard the turning of the valve to increase or decrease the opening of the valve.

Q. 589. And assuming still that such plug-cock were connected up with a governor likewise attempting to govern the water wheel, supplied with water through the pipe 46, and varying the amount of water supplied to such wheel, what would be the effect upon the sensitiveness or responsiveness of action of such governor, due to the pressure of such water upon this plug-cock valve?

A. The effect of the pressure on the stop-cock valve would be to retard the governing, or it would be necessary for the mechanism which responds, through any appliance, to a change of speed, to first overcome the friction before the valves were put in motion, and as this friction is increased, the delay in the movement of the valve would be increased, thereby diminishing very materially the sensitiveness of the governing mechanism.

Q. 590. If the co-efficient of this friction existing between such stop-cock valve and its case in such train of mechanism, including a governor, were so high as to produce a retarding action greater than the impelling force applied to the governor itself, what would be the effect upon the operation of the governor?

A. The governor would not act at all, because the valve would not be moved, on account of the excessive friction.

Q. 591. In your previous testimony you have discussed a water-wheel governor known as the Lombard governor, and exemplified in Complainant's Exhibit X, Lombard Governor Company illustrative Folder of Lombard Governor Device. Now, assuming that in a given hydroelectric installation, such a Lombard governor were installed for governing the wheel, and there were connected up with it a by-pass having therein a stop-cock valve similar to that you have discussed in connection with this blueprint still before us, what would be the effect upon the operation of such Lombard governor of the friction engendered between the stop-cock and its case, in an attempt to turn the stop-cock, assuming that such stop-cock were of a size proportionate to the dimensions and the general capacities of the governor and other features of the plant?

A. The effect would be, if such a governor as the socalled Lombard governor, which governor actuates as a result of a change of speed, that, on account of the excessive friction of the stop-cock type of valve in the by-pass, the speed would change very materially before the governor would cause any change in the position of the

by-pass valve, and if the friction were sufficiently excessive, it is very probable that some part of the governing mechanism might be insufficiently strong to change the position of the by-pass valve of the stop-cock type. At any rate the friction would cause a decided change in speed before the valve would be moved to correct for this change of speed; causing what is always termed a governor that works sluggishly, or is not properly sensitive to small changes of speed.

Q. 592. And what would be the effect on the governing or regulation of the water wheel included in such system?

A. The governing or regulation would be quite unsatisfactory.

Q. 593. And what would be the effect upon the maintaining of the water wheel at a proper normal speed to prevent fluctuation in the circuit supplied by the generator included in such system?

A. The effect would be that it would be impossible to maintain a uniform speed of the water-wheel under such conditions.

Q. 594. And would that, or would that not be considered a satisfactory, or in any sense suitable governing, in the present state of the art of hydroelectric practice?

A. It would not only be unsatisfactory, but under present operating conditions it would be intolerable and absolutely out of the question.

Q. 595. Assuming the plug-cock valve in this Berry Blueprine No. 1 before us to be of dimensions in proportion to the other dimensions indicated in the blue-

print, such as the dimensions of the water wheel and penstock, and that there were approximately 600 feet head of water supplying such penstock 46, can you state approximately what the frictional factor would be as existing between the stopcock and its case in an attempt to turn the stopcock?

A. In my opinion the friction would be so great that no possible governing mechanism would move the valve under such conditions, at all.

Q. 596. Now, referring further to Complainant's Exhibit A, being copy of the Lyndon patent in suit, what type of valve do you find as disclosed in this patent as installed in the by-pass 47?

A. The type of valve is what is commonly known as a butterfly valve; this being definitely indicated by the sentence on page 2 of the patent, beginning with line 73, and reading as follows: "A valve 48 in this by-pass is operated by ropes 51, 52, attached to opposite end of a lever 50 on the stem 49 of said valve, these ropes passing over idlers 53 and around pulley 54, being secured at the ends to said pulley."

Q. 597. What is the distinguishing characteristics of such a butterfly valve?

A. The distinguishing characteristics of such a butterfly valve is that it is what is commonly called a balanced valve, and no matter what is the difference in pressure between the two sides of the valve, there is no change in the amount of turning effort required to change its position; nor is there in such a by-pass valve any friction whatsoever in its action between the outside casing and the valve itself.

Q. 598. And as a by-pass valve to be connected up with any governor, or a governor such as the Lombard governor we have just referred to, for the purpose of governing a water-wheel, what have you to say in comparing the performance of such a butterfly valve with the performance of a stop-cock valve such as that you have discussed in connection with Berry Blueprint No. 1, still before us?

A. The operation of the butterfly valve, being free from friction under any conditions of operation, will be much more easy; will at all times be in a balanced condition, whether entirely opened, or entirely closed, or at any intermediate point; and in changing the position of the balanced valve there will be no friction whatsoever to overcome; while in the stop-cock type of valve it is impossible to eliminate the friction, particularly at such time as the valve is set in one position; with the general result that the operation of such a butterfly valve in a by-pass, in connection with the operation of a governor, will give a very much more satisfactory result in connection with the maintaining of a constant and unvaried speed of rotation.

Q. 599. And in the use of such butterfly valve in a by-pass, will there or will there not be any tendency of the valve to stick and oppose the commencement of its movement, responsive to the governor?

A. There will be no tendency to stick as the result of friction.

Q. 600. And how with respect to the use of the stop-cock valve in a by-pass?

A. The stop-cock valve would be, as the result of

friction, held in a given position until sufficient thrust should come from the governing mechanism to start it in motion, after which this thrust would be more than necessary to move it, and would therefore result in the valve being opened farther than necessary.

Q. 601. Will you please now compare the action of the stop-cock valve of Berry Blueprint No. 1 and the case with which it frictionally engages with the action of a band brake and the service to which the band brake is applied?

A. Well, the comparison would be as follows: The rotating cylindrical body of the stop-cock type of valve would correspond with the pulley; the outer surface of the cylindrical body of the valve corresponding with the pulley face. The valve casing would correspond to the brake or brake shoe that is pressed against the cylindrical stop-cock body, and the friction is therefore the same between the rotating cylindrical stop-cock body and the casing of the valve, as is the case with a rotating pulley or wheel, when pressure or friction results between the face of the pulley and the brake itself.

Q. 602. What, in this braking action of the stop-cock in its case, corresponds to the pressure applied to the brake shoe to bring it against its co-engaging part?

A. The pressure of the water in the pipe 46 corresponds to the pressure which would be exerted upon the brake shoe.

Q. 603. What would be the result upon the proper ~~action~~ of a water wheel governor if such a brake were included in the train of parts connected up with the governor and intended to be moved thereby?

A. It would delay, or, if the braking effect were sufficient, prevent the movement of the valve and make the governing entirely unsatisfactory.

Q. 604. Would it be possible for any smooth uninterrupted governing movement to take place with such a retarding brake?

A. In my opinion it would be impossible.

Q. 605. Did you ever know or hear of a successfully operating water wheel governor, to the train of moving parts of which such a brake device was applied?

A. No, sir, not when continuously applied; the difficulty being that the friction will vary with conditions that are absolutely beyond control, due to foreign matter or grit, or sand in the water, or change of temperature, or wearing of the surfaces which are always rubbing together, namely, the surface of the cylindrical body of the stock-cock valve, and the containing case.

Q. 606. And irrespective of what the fit between the stop-cock and its case may be, assuming such a stop-cock and case were provided in connection with such a governing apparatus, would or would not such co-efficient of friction exist between the case and the stop-cock?

A. The friction would exist quite independent of any possible construction of adjustment, or condition of operation.

Q. 607. And would or would not the pressure of the water always hold the stop-cock against its case?

A. Yes, sir.

Q. 608. Have you ever heard of any such governing mechanism, in the train of moving parts of which a retarding brake was included, so that its action would

occur during the movement of the governor part in the governing of the wheel?

A. No, sir, I never have.

Q. 609. In your previous testimony you have referred to a number of complainant's exhibits disclosing the alleged infringing structures of the Division Creek plant and the Cottonwood plant in Inyo County, California on the line of the Los Angeles aqueduct, among such exhibits being Complainant's Exhibit KKK. Referring to this Complainant's Exhibit KKK, what type of water wheel gate valve and by-pass valve is disclosed therein?

A. The so-called needle type of valve for both the water gate valve and the by-pass valve.

Q. 610. How does that needle type of valve compare with the butterfly type of valve disclosed in complainant's exhibit A (copy of the Lyndon patent in suit), in the particulars which you have discussed to-day?

A. The needle type of valve, and the butterfly type of valve have, in common, the elimination of friction of the moving part of the valve on its seat or casing, as a result of the pressure of the water. Both the butterfly type of valve and the needle type of valve have, in common, the characteristic that the degree of opening of the valve may be at any time changed, whether from the position of being entirely closed to the position of being entirely opened, without necessitating the overcoming of any friction between the moving part of the valves and the surrounding case.

Q. 611. Is there, or is there not any essential difference between the needle type of valve and the butter-

fly type of valve, as far as the responsiveness of the same to governing action is concerned?

A. There is no essential difference, no, sir.

Q. 612. I now call your attention to "Complainant's Exhibits Wilson sketches A, B, C, D, and E", and will ask you if you understand what is portrayed therein?

A. I believe that I am familiar with what is indicated in the drawings and lettering of the five exhibits mentioned, A to E, inclusive.

Q. 613. Do you find shown therein any friction types of valves?

A. Yes.

Q. 614. Do you find disclosed therein any frictionless types of valve?

A. Yes.

Q. 615. Please state where, in these sketches, you find these samples of valves?

A. In "Exhibit A" there is shown the frictionless valves, both for the water gate and the by-pass, these valves being of the needle type. In Exhibit B there is shown a by-pass valve of the butterfly type, which is frictionless; and also water gate valves that are frictionless. In Exhibit C there is shown a by-pass valve of the stop-cock type, in which it is impossible to eliminate the friction resulting from the water pressure; and there are also shown water gates of the frictionless type. In Exhibit D there is shown a by-pass nozzle and also a water-wheel nozzle, the opening or closing of both of these nozzles being accomplished by a valve plate; the friction between this valve plate and the valve seat being dependent almost directly upon the water pressure,

itself, and is of a particularly striking type of valve as regards excessive friction resulting from the water pressure. In Exhibit E there is shown a water gate valve, and also a by-pass valve, the opening and closing of both of these valves being accomplished by plates, there being a separate plate for the water gate valve from the plate of the by-pass valve. In these type of valves there is inevitably excessive friction as a result of the water pressure.

Q. 616. I now call your attention further to Berry Blueprint No. 1 still before us, and Defendant's Exhibits MZ, ZZ and XX, and ask you if you understand generally what is disclosed in these exhibits, referring particularly to figure 1 of Berry Blueprint No. 1, taken in connection with the other three exhibits.

A. I have examined them, and I believe I do understand how the mechanism is constructed, and how it is operated, and the method of its use.

Q. 617. By what shaft do you understand the fly-wheel M of Exhibit MZ, and the fly-wheel B of Exhibit ZZ, is carried?

A. The fly-wheel M is carried by the shaft A in Exhibit MZ. The fly-wheel B is carried presumably by the shaft which is marked H. In figure 2 of the Berry Blueprint No. 1, the fly-wheel 1 is carried by the shaft 11.

Q. 618. Which is the shaft of which apparatus, the water wheel, or the generator?

A. It is the shaft of the generator.

Q. 619. Do you take it that these several exhibits are intended to agree with respect to the mounting of this fly-wheel?

A. I do, yes.

Q. 620. Then assuming the fly-wheel to be carried by the generator shaft, and the part B in Exhibit MZ to be carried by the water-wheel shaft, how is the rotation of the water wheel shaft transmitted to the generator shaft?

A. The power is transmitted from the water wheel shaft to the generator shaft (referring to figure 1 of Berry Blueprint No. 1) through the links 6, 6, connected to the lever arms 2, 2, which are pivoted respectively, at the points 4, 4, containing weights respectively 3, 3.

Q. 621. And the lever arms are pivoted at 4, 4, to what?

A. Pivoted at 4, 4, to the spokes of the fly-wheel 1.

Q. 622. What determines the positions of those lever arms?

A. The position of the lever arms, 2, 2, is determined by the balancing of two forces—one, the force resulting from the speed of the rotation of the fly-wheel 1 tending to throw out the weights, 3, 3, the restraining force to this throwing out as a result of the speed, being accomplished by the tension of the springs, 5, 5, with the result that when the fly-wheel is at rest the lever arms 2, 2 will be held down and in contact with the lugs, not numbered, on the interior of the fly-wheel, but as a result of the tension of the springs, 5, 5. But, as the speed of rotation increases, the lever arms 2, 2, will be thrown out on account of the rotation acting on the weights 3, 3.

Q. 623. Now, let us assume that the generator is being driven by the water-wheel at normal speed at normal load; what will be the position of the lever arms 2,

2, with respect to the position shown in figure 1 of Berry Blueprint No. 1?

A. The lever arms 2, 2, will be thrown out from contact with the lugs at the ends of the lever arms 2, 2, and restrained from being thrown entirely against the rim of the fly-wheel by the tension of the springs 5, 5.

Q. 624. Now, let it be assumed that the lever arms 2, 2 are connected up with the water wheel gates to move the same in closing and opening directions and in governing action, and the load upon the generator is reduced; what will be the direction of movement of the lever arms 2, 2?

A. If the load upon the generator is reduced, and all other conditions remain the same, particularly the water pressure, the tendency will be for the lever arms 2, 2, to be thrown out, as a result of the increased speed.

Q. 625. Now, let us assume that the load on the generator remains constant, and the levers 2, 2 are in their normal position, and the speed of the water wheel is increased; what will be the effect produced upon the lever arms 2, 2?

A. If the speed of the water wheel is increased?

Q. 626. Yes.

A. And if all other conditions remain the same?

Q. 627. Yes.

A. Then the lever arms 2, 2 will be thrown out towards the rim of the fly-wheel.

Q. 628. Then, am I to understand that the same direction of movement of the lever arms takes place, either upon decrease of load upon the generator, or increase of speed of the water wheel?

A. Yes, sir.

Q. 629. Now, under both of these conditions is it or is it not true that the rotation of the water wheel shaft is still imparted to the generator through these pivoted lever arms 2, 2?

A. Yes, sir.

Q. 630. And if, as supposed, the lever arms are connected with governing mechanism for controlling the positions of the water wheel gates, does it or does it *not* follow that the movements of these lever arms, upon change in load, or change in speed, is affected by the transmission of rotation from water wheel to generator through these arms?

A. Yes; the fact being that the device as set forth in Exhibits MZ and ZZ, and in figure 1 of the Berry Blueprint No. 1, is in reality not the governor at all; it is essentially and fundamentally what is commonly known as a transmission dynamometer, or a device to measure the amount of power transmitted between two shafts that are not otherwise connected together except by the device, the transmission dynamometer itself. Independent of the speed, within reasonable limits, and of the load, so-called, within reasonable limits, the position of the lever arms 2, 2 will depend only upon the amount of power that is transmitted, which amount of power transmitted is made up of the product of the speed of rotation and the amount of effort necessary to turn the driven shaft.

Q. 631. Is it or is it not proper to say, in consideration of this device shown in the exhibits now before us, that the transmission of power from the water-wheel

shaft to the generator takes place through the element which in turn actuates the governor?

MR. WESTALL. That question is objected to as leading.

A. Yes.

Q. 632. (BY MR. BLAKESLEE:) What have you to say in this connection as to the accuracy, responsiveness and sensitiveness of governor operation by any such primarily transmission element as you have pointed out this device, including the lever arms 2, 2, to be?

A. I should say that as a governor for constant speed it could not possibly work satisfactorily, because of the fact that it is responsive to a change of load, even if the speed is absolutely constant; and at the same time it is responsive to a change of speed, even if the load is constant. The device would work satisfactorily if this were the desired result, namely, that the amount of power to be transmitted between the water wheel shaft and the generator was to be maintained constant at varying speeds, or, to put it more directly, it is not only responsive to change of speed, other things being equal, but it is responsive to change of load, even if the speed is absolutely constant; and, due to this latter fact, it could not possibly operate satisfactorily to maintain constant speed of the generator with varying loads upon the generator, it being a transmission dynamometer rather than a constant-speed governor.

Q. 633. As far as accurate or satisfactory governing by the use of any such device as we are discussing is concerned, please compare the action of this device as shown in these exhibits, with the lever arms 2, 2 free

to play pivotally, and the action of such device, if such lever arms were fixed or locked against any play whatever, keeping in mind the conflict which you have testified as existing between the attempts of the pivotally mounted lever arms 2, 2 to shift their positions upon change of speed or load, and the power applied through them from the water wheel shaft to the generator?

A. If the arms 2, 2 were not restrained by the tension of the springs 5, 5, at a very small speed of rotation they would be thrown out so that the ends would strike against the interior of the fly-wheel rim.

Q. 634. Possibly my question was somewhat involved, and I will restate it this way; inasmuch as you have testified that a conflict exists between the attempts of the pivotally mounted lever arms 2, 2 to change their positions, responsive to change in load or change in speed, and the force of the drive through these lever arms from the water wheel to the generator, what have you to say in comparison of the pivotal mounting of these arms with the fixed mountings of these arms, as far as obtaining any satisfactory governing action is concerned?

A. I don't know that I can answer that question except in a general way, to say that the governing would be practically as good if the arms 2, 2 were rigid, and not free to rotate as if they are affected by the weights 3, 3.

Q. 635. Referring again now to the Lombard Governor, to which you have testified, as portrayed in Complainant's Exhibit X, Lombard Governor Illustrative Folder of Lombard Governor Device, can you conceive of any possibility of transmitting the rotation of a water wheel shaft through the speed-sensitive parts connected

with the fly-balls 30, so as to operate the generator, and at the same time permit the governor to operate and produce any satisfactory governing result?

A. A satisfactory governing result would be absolutely impossible under such circumstances.

Q. 636. And is or is not that true, regardless of the size or dimensions of such speed-sensitive parts?

A. Absolutely independent of the size, dimensions, material or construction or anything else, of the parts themselves.

Q. 637. Do you find in Berry Blueprint No. 1, taken with "Defendant's Exhibits MZ, ZZ and XX", any governor device which corresponds in construction, function or performance, with, or is in any sense equivalent to the governor mechanism of Complainant's Exhibit A?

A. No, sir, I do not, for the reason that in the Lyndon disclosure the governing mechanism is entirely dependent upon speed, absolutely irrespective of load, a change in the speed of rotation causing the governing mechanism to act; while in the Berry Blueprint No. 1, and in Exhibits MZ, ZZ and XX the operation of the device changing the wheel gate opening, as well as the by-pass opening, is just as effectively brought about by a change of the load, with constant speed, as it is with a constant load and a variable speed. In other words, the two have an entirely different object, and work absolutely to get a different result.

Q. 638. Are we to understand you as testifying that the construction in these exhibits would as a fact produce any movement of the water-wheel gate, or of the by-pass device, or both, as a certainty?

A. Referring to the Berry Blueprint?

Q. 639. Yes, referring to the Berry Blueprint No. 1 and associated exhibits?

A. No, there is no certainty that a change of speed would cause any movement whatsoever of either the water gates, or the by-pass valve.

Q. 640. How about change of load?

A. Change of load might come about without in any manner causing any change in the position of the water gates, or the by-pass valve.

Q. 641. In the action of the governor mechanism of Complainant's Exhibit A, does it or does it not make any difference whether the head or volume of the water supplied to the wheel varies, or any other condition varies, namely, any condition affecting the water wheel, as far as responsiveness of the governing mechanism is concerned?

A. No, the water pressure might vary within very wide limits, and every other condition might vary within the widest possible limits, but the only condition which would affect the governing mechanism would be a variation in the speed of rotation of the wheel itself. In other words, it is a speed-regulating device, or governing mechanism definitely and specifically, independent of all other variable factors.

Q. 642. Now, is or is not that also true with respect to the action of the Lombard governing mechanism, as you have found it to exist in the defendant's alleged infringing structures, as portrayed, for instance, in Complainant's Exhibit KKK?

A. Yes, the same is true as regards Complainant's Exhibit KKK, setting forth in detail the operation of

the Lombard governor to maintain constant speed, irrespective of variation in head upon the water wheel, load upon the generator, or any other condition of operation.

Q. 643. And is the same also true with respect to defendant's alleged infringing structure portrayed in Complainant's Exhibit LL?

A. Yes, the same is true of Complainant's Exhibit LL, which is an exhibit showing a governor for the purpose of maintaining constant speed of the generator irrespective of variation in load upon the generator, water pressure in the pipe line, or any other conditions.

Q. 644. Referring to the disclosures of Defendant's Exhibit Berry Blueprint No. 1, and Defendant's Exhibits ZZ, MZ and XX, what, if any provision is there made for taking care of or governing, in view of changes in volume or head of water supplied to the wheel?

A. There is no provision whatsoever made in the devices as set forth in Berry blueprint No. 1, and Defendants' Exhibits XX, MZ and ZZ.

Q. 645. Do you consider the disclosures of these four exhibits last named to comprise, either theoretically or practically, operative, satisfactory or successfully working design and construction?

A. Fundamentally, both theoretically and practically unsatisfactory in design and conception for the purpose of maintaining constant speed with variation of load, variation of head, and other variable conditions inseparably connected with the practical operation of electrical generators driven by water wheels.

Q. 646. Do you find the whole of, or any essential

part of the invention disclosed in Complainant's Exhibit A embodied in the disclosures of these four other exhibits still before you?

A. The only thing in common between Defendant's Exhibit Lyndon patent, and the disclosure of Berry Blueprint No. 1, Defendant's Exhibits XX, MZ and ZZ, that I can find, is that in both a by-pass valve is mentioned; the matter of fact being that the type of by-pass valve mentioned in the Lyndon patent is entirely operative, while the by-pass valve in the Berry Blueprint No. 1, and the other exhibits mentioned would be inoperative, as a result of friction, even if it were controlled by a satisfactory governor for constant speed. That is the only thing in common in the two disclosures when contrasted.

Q. 647. Do you find ⁱⁿ ~~the~~ Berry Blueprint No. 1 and the three associated exhibits still before you, any showing or suggestion of any means whatsoever for returning the purported by-pass valve to a usual or pre-determined position after it has moved in conjunction with the water-wheel gates?

A. No, sir, I do not.

Q. 648. Referring further to Complainant's Exhibit A, will you please state from the teachings of this patent, what positions you would elect to station the by-pass valve in as its usual position under varying conditions of service, as, for instance, when you desired to save water; when the saving of water was not material, when the pipe line or penstock was long; when the pipe-line or penstock was short, and when the inclination of the pipe-line or penstock was great or small, or any

other conditions which might make the selection of such position a matter of preference, or the consideration of same wise?

A. The disclosures in the Lyndon patent set forth very clearly that the normal position of the by-pass valve may be anything which is desired by the operator to conform with the particular conditions existing; if, for instance, the saving of water is of prime importance, and there are only slight variations in the load, which will cause a variation of speed, the by-pass valve may be maintained in its normal position, practically, closed or nearly so; on the other hand, in the case of very long pipe line, or in a case of a load which is subject to very large fluctuations, these fluctuations coming very suddenly, my experience in such plants would indicate the desirability of operating the plant with the by-pass valve somewhere around half open. The adaptability of the Lyndon device to all conditions of operation, and yet maintain constant speed, is particularly important, inasmuch as what might be called the normal position of the by-pass valve can be made to suit the particular conditions existing in any given case.

Q. 649. I now call your attention to Defendant's Exhibit Cobb Efficiency Report Exhibit; Load and Speed Fluctuation Chart, and call your attention to the matter on page 19, which sets forth an efficiency of 81 2-10ths per cent at full load, with 703.1 horsepower, and ask you if you consider that to be a good efficiency under those conditions; assuming this report to refer to the operation of a hydro-electric generating plant?

A. I would assume that an efficiency of 81.2 per cent

of the water wheels at full load, corresponding to 703.1 horsepower, would be reasonably satisfactory.

Q. 650. Would that be so considered in the present state of the art?

A. For that type of wheel, yes.

Q. 651. How with respect to the types of wheels as portrayed in the various exhibits showing the defendant's alleged infringing structures, such as Complainant's Exhibits KKK, or any of the exhibits which you have reviewed in any of your testimony in this case, showing the construction of the defendant's alleged infringing structure?

A. I should think that that efficiency of 81.2 per cent at full load would be a reasonably satisfactory efficiency.

Q. 652. Strictly from the standpoint of such efficiency, would such efficiency warrant the rejection of any hydro-electric installation?

A. In my opinion it would not.

Q. 653. Would your observations likewise apply to such hydro-electric plant, the water wheels of which had a maximum capacity of 750 horsepower, instead of 703.1 horsepower; the test producing 81.2 per cent efficiency being made at 703.1 horsepower?

A. No, sir, I would not consider that, based on the efficiency only, there would be justification for rejecting a wheel of a normal rating of 750 horsepower, if at 703.1 horsepower the efficiency was 81.2 per cent.

Q. 654. I now refer you to page 17 of this exhibit, to the part entitled Table 5, and ask you whether or not you have prepared any tabulation or chart showing, which corresponds to the conditions and propositions

stated in this Table 5; and if so, please produce same.

A. Yes.

(The witness produces a chart in red and black lines, on white paper.)

Q. 655. Will you now please state what this chart signifies, pointing out the various features and details thereof?

A. This chart signifies a graphical representation of the fluctuation or changes in speed, following definite changes in load, which have been plotted from the so-called Cobb Efficiency Report, as set forth on Table 5, page 17, being the exhibit I have before me, wherein the normal desired speed is 257 revolutions per minute, and where the load was suddenly increased from 5-16ths of full load to 7-16ths of full load, the speed fluctuated between a maximum of 260 r.p.m., and a minimum of 250 r.p.m. Further, when the load was increased from 7-16ths of full load to one-half of full load, the speed fluctuated between a maximum of 260 r.p.m., and a minimum of 248 r.p.m. Again, when the load was still further increased from one-half full load to three-fourths full load the speed fluctuated from a maximum of 262 r.p.m. to a minimum of 245 r.p.m. Further, when the load was suddenly dropped or decreased from three-fourths of full load down to one-half of full load, the speed fluctuated from a maximum of 270 r.p.m., to a minimum of 247 r.p.m. Then when the load was again increased from one-half full load to three-fourths full load, the speed decreased to a minimum of 245 r.p.m., and fluctuated to a maximum of 262 r.p.m. And then when the load was reduced from three-fourths full load

to three-eighths full load, the speed fluctuated between the still wider limit of a maximum of 272 r.p.m., to a minimum of 245 r.p.m.

Q. 656. What do such fluctuations in speed signify with respect to any attempted governing action in this installation?

A. It signifies absolutely unsatisfactory governing action, because what should occur, and actually does occur in the properly governing devices, if the load, for instance, is increased the speed may drop ~~to~~^{two} or three revolutions, but does not ever exceed normal speed. In other words, to use the common engineering expression, the speed does not fluctuate above a normal and then below normal, and then above normal, and finally return to normal speed.

Q. 657. And that back and forth fluctuation occurs in accordance with the chart readings you have just recited, and a "hunting" action of the governor take place?

A. Yes, sir, it did, as set forth in Table 5, page 17, of the Cobb Efficiency Report.

Q. 658. And what was the effect upon the electrical energy consumers supplied by the circuit energized by this plant upon which this report was prepared?

A. A very wide fluctuation, not only of the electric pressure or voltage, but what is perhaps of even more serious consequence, with electric motors, a fluctuation of the frequency of the alternating current supplied from such generator, which frequently is directly proportional to the speed in revolutions per minute.

Q. 659. And would such energy consumers be serviceably so supplied with energy in the industries today?

A. Such service would not be at all possible with electrical consumers at the present time, where the fluctuation of frequency is many times limited by contact, not to exceed as a maximum one per cent either above or below normal.

Q. 660. What is indicated on this chart in the central portion of it?

A. In the central portion is indicated the normal speed with a good speed governor, wherein is shown the reduction in speed from the normal operating speed of 257 r.p.m., to about 255 r.p.m., when the load is increased from 5-16ths of full load to 7-16ths of full load. Again, a reduction from the normal speed of 257 r.p.m. to a little less than 256 r.p.m., the load was still further increased from 7-16ths of full load to one-half of full load; and a reduction from the normal speed of 257 r.p.m., to approximately 253 r.p.m., the load was still further increased from one-half of full load to three-fourths of full load; and then when the load was decreased or reduced from three-fourths of full load to one-half of full load the normal speed of 257 r.p.m. was increased thereby to 261 r.p.m.; and then, when the load was again raised from one-half of full load to three-fourths of full load, the normal speed of 257 r.p.m. was reduced again to 253 r.p.m.; and then again, when the load was reduced or decreased from three-fourths of full load to three-eighths of full load, the normal speed of 257 r.p.m. was thereby increased to 263 r.p.m. In no case, however, in this proper speed governing, after the speed is reduced as a result of increasing the load, is the speed allowed by the governor to increase above normal

by the so-called "hunting" action; nor, on the other hand, when the speed has been increased as a result of the reduction in load, will the speed fluctuate below normal, because the proper action of the governor provides this wide fluctuation or so-called "hunting."

Q. 661. And the fluctuations indicated in the upper tier of this chart, compared with the fluctuations indicated in the central tier of this chart, show, do they, the differences between the fluctuations indicated in this Cobb Efficiency Report and the fluctuations which should occur in a well-governed hydro-electric plant under similar conditions?

A. Yes, sir.

MR. BLAKESLEE: Upon preparation of a photographic copy of this chart we will offer the same in evidence as Cobb Efficiency Report Exhibit; Load and Speed Fluctuation Chart.

Q. 662. I now call your attention to that matter on page 18 of this "Defendant's Exhibit Cobb Efficiency Report" as follows:

"The by-pass valves are not reliable and have so far given a great amount of trouble, and should be replaced by a construction that will render it possible to operate them with certainty by the hydraulic cylinder provided in part for that purpose".

Does this observation in the report coincide with your engineering opinion and belief as to the theoretical and structural objections pertaining, and the disclosure of Berry Blueprint No. 1, or a device built in accordance therewith, and in line with your testimony of this afternoon?

Q. 663. And in connection with this same observation, if you were to replace the by-pass valve or valves by another construction that would render it possible to operate them with certainty, what type of by-pass valve would you substitute?

A. I would substitute some type of practically frictionless by-pass valve, such as a butterfly valve, or a needle valve.

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Q. 664. I will call your attention again, Mr. Cory, to Complainant's Exhibit A (copy of Lyndon patent in suit), and will ask you whether, in accordance with any interpretation of the disclosures of that patent, it would be possible to transmit the rotation of the water wheel to the generator through the agency of the speed-sensitive dynamo device 8 disclosed in that patent?

A. Yes, sir, it would be possible.

Q. 665. If that were done would or would not such speed-sensitive element be permitted to perform its proper function as a member of the governor organization?

A. Yes, sir, it would perform the same function.

Q. 666. How would it be possible so to connect up the water wheel and generator through this dynamo 8?

A. It would be possible in a number of different ways. Perhaps the most apparent one would be to mount the speed sensitive device 8 on the same shaft as the main shaft of the water wheel which drives the generator; in which case the speed-sensitive device and the water-wheel shaft and the generator shaft would all be practically operated on the same shaft and therefore at

the same speed; which would be practically the equivalent of the disclosure as set forth in the Lyndon patent.

Q. 667. In that case would the joint operation of the water-wheel and generator and the dynamo 8 coupled up with them, in any way change the performance of the speed sensitive dynamo 8?

A. No, there would be no change whatever in the operation of the entire equipment, including the speed-sensitive device or dynamo 8.

Q. 668. And if the wheel, generator and dynamo 8 of the Lyndon patent disclosure were so connected together, would or would not the speed-sensitive field of the dynamo 8, which changes the pull upon the solenoid 33, be affected?

A. It would not be affected at all.

Q. 669. What I was aiming at in a previous question was to determine whether the wheel of the Lyndon patent and a generator operated thereby could be connected up through the agency of the speed-sensitive part of the dynamo 8 so that the generator could be operated by water wheel through such speed-sensitive part, and such speed-sensitive part still retain its speed-sensitive function for governing purposes?

A. Yes, sir, it could so be done and get exactly the same result as regards the operation of the speed-sensitive dynamo 8.

Q. 670. I am now assuming that the speed sensitive dynamo 8 is operated from the wheel shaft, and further assuming that the generator is to be further operated through the energy generated by the dynamo 8, and a further motor to operate the generator; calling your at-

tention to the fact that the specification of the Lyndon patent, in the last paragraph on page 2—that the dynamo 8 is compound wound in a manner to give constant potential at the terminals with constant speed, independent of the variation of current; and also to the matter in lines 39 to 46 on page 3, which set forth that a slight increase in speed of the armature will give an increase in voltage, due first directly to the increase in speed, and second, to the increase in magnetic density which later increases because of a greater current flowing through the shunt windings, caused by the slight increase of voltage. Would it be practicable or possible to so cause the final drive of the generator supplied by the wheel and at the same time obtain sensitive governing action?

A. I presume by the word “generator” you refer to the main electrical machine driven by the water wheel from which electric power is taken.

Q. 671. Yes, I have distinguished by calling number 8 a dynamo, and the generator I refer to is the generator driven by the water wheel for supplying the service from the station.

A. No, it would make no difference whatsoever in the operation of the speed-sensitive device or dynamo 8 if the current from this dynamo 8 in part were used to excite the field of the main generator, using the alternating current, in addition to there being supplied also from the small dynamo 8—the speed-sensitive device—current for the operation of the solenoid 33; in which case dynamo 8 would be used for two purposes; first, the speed-sensitive device in connection with the operation of the governor, and, second, as a direct-cur-

rent machine, ordinarily known as an exciter, to furnish direct current to the fields of the main alternating current generator driven by the water-wheel.

Q. 672. But, my question involved, not the excitation of the field of the main generator, but rather, the energization of a motor to rotate the field or armature of such main generator. Under those circumstances would practicable governing be possible?

A. I doubt it very much, because in that case the dynamo 8 would be as large a machine as the main generator, and it would also supply energy for the motor, which would, in turn, drive the main generator, and sudden fluctuations of load upon the main generator would interfere somewhat with the uniformity of the current that would also be delivered from the small dynamo 8, which would now be a large direct current dynamo supplying to the coil 33. Still, it might be possible to get satisfactory governing, although it would add an additional burden to the speed-sensitive device—the small dynamo 8—to operate in this manner.

Q.; 673. If you operated in such manner, would or would not fluctuations in the circuit supplied by the service generator affect the potential of the dynamo 8 in such manner as to impair its function as primarily a speed-sensitive governor controlling element?

A. In my opinion it would in practical operation seriously impair its effectiveness as a speed-sensitive device.

Q. 674. And would not, of necessity, the dynamo 8, so utilized in such dual capacity, be larger, in terms of capacity, than the generator driven through it?

A. Yes, sir.

Q. 675. What have you to say as to any loss of energy in such combination of features, incident to conversion and a reconversion of energy by the use of two generators and interposed motor?

A. There would be considerable excess and unnecessary loss between the mechanical power delivered from the water-wheel and the electrical energy ultimately delivered from the main generator.

Q. 676. Therefore, in these connections, is there or is there not any analogy between the impracticability of so driving the service generator of the plant through the speed-sensitive dynamo 8 of the Lyndon patent disclosure, and the impracticability you have pointed out of driving the service generator through the speed-sensitive element, including the fly-balls marked C, of Complainant's Exhibit KKK, as exemplifying the defendant's alleged infringing structures?

A. Yes, sir, there is an analogy.

Q. 677. In the construction disclosed in Defendant's Exhibit Berry Blueprint No. 1, please again state whether or not the drive of the service generator takes place from the water wheel through the intended speed-sensitive part of the dynamometer shown particularly in figure 1, such part including the weighted lever arms, 2, 2?

A. The service generator, as shown in the Berry Bluperint No. 1, is driven by the water-wheel through the power transmission dynamometer as shown in figure 1; and therefore, not only interferes, but absolutely prevents the power transmission dynamometer figure 1,

from being a speed-sensitive device solely; since all the power required by the main generator must be transmitted through the device as a power transmission dynamometer.

Q. 678. And is it or is it not so transmitted through the movable pivoted lever arm, 2, 2 of this device?

A. Yes, sir, all of the power is transmitted through the lever arm 2, 2, the links, 6, 6, and the crank shaft, 7.

Q. 679. Do you find any suggestion in the disclosure of Complainant's Exhibit A, of any intention or design to drive the service generator through energy developed by the speed-sensitive dynamometer 8?

A. No, sir.

Q. 680. If the lever arm 2, 2 of Berry Blueprint No. 1, and particularly as shown in figure 1 thereof, were locked or stopped against pivotal movement or swing, what would be the result, nature and function of such dynamometer interposed between the water wheel and the service generator?

A. The dynamometer, which I have called a power transmission dynamometer, would then become in effect merely a solid rigid coupling between the water-wheel shaft and the generator shaft.

Q. 681. I call your attention now again to Defendant's Exhibit Lamb patent, and ask you if you find therein disclosed any means for producing a positive inverse movement as between the two valves 9 in any possible governing action of this device?

A. No, sir; there is no positive inverse motion possible as regards the two different valves; the

reasons for this being that the governor is presumed to exert a pull upon the rod 25, which is connected to the center of the bar 24, and the valves themselves are operated respectively by the two lever arms 20, and all of the motion caused by the governor in acting upon the rod 25 will be directly transmitted to either the one valve or the other, depending upon which operates with the least friction; there being absolutely no positive, definite inverse action possible between the two valves, since one may move for a considerable distance without the other moving at all, and vice versa.

Q. 682. And as to these valves 9, themselves, within which class, if either, of valves, as previously defined by you—namely, friction valve, or frictionless valve—do said valves 9 fall?

A. The valves 9, as definitely stated on page 2, line 18, are “cylindrical in form, turning in enclosing cases 10 within “the reservoir 4”, and are therefore valves of the friction type, and are not balanced.

Q. 683. What, if any, effect would be produced by this frictional character of these valves 9 upon the action of the lever connection for moving such valves, from the standpoint of the lack of positiveness of inverse synchronous action which you have referred to?

A. The effect of the use of friction valves would be to absolutely prevent the inverse synchronous action of the two valves by the pull or thrust upon the connecting rod 25 from the governor; all of the motion would be transmitted to the valve which had

the least friction—at least, during the first part of the action.

Q. 684. How much of the water admitted to the casing or supplied to this wheel strikes the wheel itself?

A. All of the water strikes the wheel.

Q. 685. I now show you a model device, and will ask you to please compare the same generally with the disclosure of this Lamb patent, and state whether or not it generally conforms to such disclosure with respect to the action of the valves 9 of said patent and the means for operating them in any attempted governing action?

A. The model conforms with the disclosure of the patent, particularly as shown in Figure 4 and the specification describing the operation of the governor rod 25 and the valves.

Q. 686. Will you please state what, if you understand, is the purpose of the frame at the lower part of this model, and the compression springs between the frames and the valves?

A. The two spiral compression springs on the bottom of the model are representative of the water pressure exerted upon the two cylindrical valves 9.

Q. 687. And what is the effect of that water pressure, as to the turning of the valves?

A. The effect of the water pressure is to increase the friction with which the valves operate, particularly the friction which must be overcome upon the initial movement of either valve.

MR. BLAKESLEE: Complainant offers in evi-

dence the model device pertinent to the Lamb disclosure just discussed by the witness, as Complainant's Exhibit Lamb Patent Valve Gear Model," and ask that it be so marked.

MR. WESTALL: Counsel for the defendant objects to the receipt in evidence of the model referred to, as not being shown to be made in accordance with the specifications and drawings of the patent referred to, and as being merely fragmentary.

Q. 688. (By MR. BLAKESLEE:) Does or does not the purported action of the device of this Lamb patent provide for anything further than shutting off a part of the water supplied to the wheel at one nozzle and applying it to the wheel at another nozzle?

A. It does not, the result being that the flow of water through the pipe line is constant at all times, no matter what the load upon the generator may be, so far as doing useful work.

Q. 689. And would the use, or attempted use of any such Lamb device contemplate the taking care of any inertia effect in the pipe line?

A. No, sir; it would not.

Q. 690. As a matter of fact, if the valves of this Lamb patent device did not work simultaneously and inversely, would or would not inertia effects be produced in the pipe line?

A. Yes. The way the disclosure of the patent is indicated to my mind there might be most serious inertia effects in the pipe line, because, as far as the governor rod 25 is concerned, it might stay absolutely still, and yet, due to the fact that there is no in-

verse positive motion whatsoever between the two valves, the entire supply of water might be suddenly cut off, or, if there was a small amount of water flowing in the pipe line, the amount of water might be very suddenly increased, absolutely independent of any control whatsoever by the governor; this being true because of there being no definite, direct and positive relative action between the power-producing valve and the so-called brake-valve. For this reason, in my opinion the entire Lamb device for constant speed control is absolutely inoperative and fundamentally wrong.

Q. 691. Does the same objection lie against the attempted use of any such Lamb device for preventing dangerous inertia effects in the pipe line? .

A. Yes, sir.

Q. 692. Referring now further to the defendant's alleged infringing structures as shown in the several blueprints and other exhibits which you have discussed in your previous testimony, and also referring to Complainant's Exhibit A (copy of Lyndon patent in suit), I wish to ask you a number of questions pertinent to correspondence as between various features of these constructions. I will select Complainant's Exhibit KKK as typical of these defendant structures. In the first place what if any analogy do you find between the fly-ball speed sensitive device, including the fly-balls C of KKK, and the dynamo 8 of the Lyndon patent?

A. The fly-balls C of the speed-sensitive device

KKK correspond to the speed-sensitive device, dynamo 8.

Q. 693. Is there or is there not any difference between the two with respect to the purpose accomplished, the general method of accomplishment, and the general character of means for accomplishing such purpose?

A. No sir.

Q. 694. Now, similarly, what have you to say with respect to the solenoid 33 of the Lyndon patent, and its core 34, and the line-to-line valve B in its casing of KKK?

MR. WESTALL: Counsel for defendant objects to this method of examination as very grossly leading, and it is suggested that the witness should be permitted to pick out the alleged analogous elements.

A. The same applies, and complete and definite testimony in regard to the relative functions of the different parts, as shown in the Lyndon patent, and as designated on blue print KKK, has already been given in great detail in my previous testimony.

Q. 695. (By MR. BLAKESLEE:) Please state whether or not you consider the general disclosure of exhibit KKK and the general disclosure of the Lyndon patent in suit, to represent mechanical equivalents, in as far as the disclosure of Complainant's Exhibit KKK performs the function of inversely moving the water wheel gate or valve and the by-pass gate or valve, returning the by-pass gate or valve to usual position, preventing the overrunning of the

governor and the operation of the governor through a strictly speed-sensitive device?

A. I consider, as set forth completely and in detail in my previous testimony some time ago in this case, that the disclosures of the Lyndon patent are substantially equivalent in every respect to the device set forth on Complainant's Exhibit KKK, and especially as regards the positive inverse action of the water gate and the by-pass valve.

Q. 696. And is there, in your opinion any appreciable difference with respect to the returning off the by-pass valve to its usual position, and also with respect to the prevention of overrunning of the governor?

A. No, sir; there is no difference.

Q. 697. Is there in your mind any want of mechanical equivalents as between the operation of a device or movement of a part through a mechanical train or mechanical group of parts, and the operation of such device or movement of such part through a train or path, either entirely electro-magnetic, or partly electro-magnetic and partly mechanical?

A. No, sir.

Q. 698. Would you consider that a cam and a toggle-joint which both operated to produce substantially the same results in the two machines would be mechanical equivalents?

A. I should say they would be mechanical equivalents as far as the result obtained.

Q. 699. And to your mind would it make any difference as to how the cam and the toggle-joints

were actuated, or how power was applied to them to produce the ultimate movement or effect?

A. No, sir, it would not.

Q. 700. And to your mind is there any advantage with respect to positiveness of transmission of motion as between a purely mechanical train consisting of a number of jointed or connected parts and a train part electro-magnetic?

A. In long-continued practical operation, where forces of considerable magnitude are to be transmitted, I would consider that it would be somewhat of an advantage to use exclusively mechanical parts, although the same definite and positive result could be obtained by a combination of electro-magnetic parts and mechanical parts.

Q. 701. In so far as lost motion is concerned is there any preference as between an electrical path of transmission and a mechanical path of transmission, the latter having parts jointed or connected together?

A. In my opinion there would not necessarily be any preference as regards lost motion, although the lost motion can be reduced to practically nothing with the exclusive use of mechanical parts. This might not be practical under all conditions possible with the combination of electro-magnetic parts.

Q. 702. But, in so far as transmissiion directly through an electrical path is concerned, what have you to say in comparing lost motion in that connection with lost motion through a mechanical train?

A. In a mechanical train I should say there would probably be less lost motion, practically none.

Q. 703. But, I am now assuming that the transmission to a certain point is entirely through an electrical path without any moving mechanical parts or connected mechanical parts; what have you to say in comparison of such path with the mechanical path or connected parts?

A. I would say to that that with the electric transmission exclusively there would be no lost motion, while there would be necessarily a very slight lost motion with a train of mechanical parts.

Q. 704. And in order to produce motion at the end of the electrical path by electro-magnetic means, is it possible to avoid the use of a moving mechanical part or parts?

A. No, sir; there must be some moving mechanical parts of electrical devices.

Q. 705. Therefore, when, in the defendant's alleged infringing structures any action takes place which corresponds to an action taking place in Complainant's Exhibit A (Copy of Lyndon patent in suit) is it or is it not true that such ultimate action is mechanical?

A. It is true that the ultimate action is mechanical.

Q. 706. And with respect to the obtaining of any such ultimate action, is it or is it not material what is the nature of the prime mover at the other end of the train, or what the nature of the train, or what the nature of causation may be?

A. I should say it would be material as to the nature of what the prime mover was; or the causation, yes.

Q. 707. Would be material?

A. Yes, I think it would be material in a broad sense. However, if the causation is definite and the same in each case, it would make practically no difference as to the transmission of that effect, whether it be by electrical means or mechanical means, or a combination of the two.

Q. 708. And in so far as the ultimate object of moving a part is concerend, where the motion is produced through an electro-magnet, is it or is it not material whether the part so moved be directly influenced by the electro-magnet as an armature, or be indirectly moved by the interposition of an armature and connections between the electro-magnet and the ultimately moved part?

A. I should say there would be practically no difference in the two cases which you cite.

Q. 709. I will now ask you to refer again to Complainant's Exhibit A, and also to Complainant's Exhibit KKK as an exemplar of defendant's alleged infringing structures, and to state whether or not you find embodied in such defendant's infringing structures the subjects of claims 3, 4, 6 and 7 of Complainant's Exhibit A?

A. I do so find, yes, sir.

Q. 710. Referring again to defendant's exhibit Berry blueprint No. 1 do you find disclosed therein

anything to prevent the governor from overrunning, within the meaning of Complainant's Exhibit A?

A. No, sir, I do not.

Q. 711. Are you at the present time connected with the faculty of the University of California, as you were when you first testified in this case?

A. Yes, sir.

Q. 712. Please state what chair you occupy in that university, or what the capacity of your membership in that university is?

A. I occupy the position of dean in the college of mechanics, which embraces the instruction in mechanical engineering, electrical engineering, steam engineering and gas engineering and hydraulic machinery, and have direct personal charge of the instruction in electrical engineering as Professor of Electrical Engineering,

MR. BLAKESLEE: We now offer in evidence blueprint of the chart discussed by the present witness yesterday, pertinent to the Cobb Efficiency Report, as Complainant's' Exhibit Cobb Efficiency Report Exhibit; Load and Speed Fluctuation Chart, and ask that the same be so marked.

Q. 713. Can you think at present of any instance within your experience or observation or knowledge, of a hydroelectric plant in which trouble resulted in the nature of extreme fluctuations in the circuit, and which troubles were eliminated by the installation, with a water-wheel gate or gates and governor, of an inversely operated by-pass valve or valves?

A. Yes, I can think of a number of instances. One I recall is that of a plant of the Truckee River General Electric Company, on the Truckee River below Floriston, California. Another plant is that of the Southern California Edison Company in San Antonio Canyon; and two plants of the Oro Water, Light and Power Company, in Butte County. There are perhaps a number of others that I do not recall just at present.

Q. 714. Do you remember any other instances of this sort in a plant of larger dimensions than those specified?

A. I have in mind the plant of the Washington Water Power Company on the Spokane River, near Spokane, Washington, and also the Crane Valley plant of the San Joaquin Light and Power Company, in Fresno County, I believe.

Q. 715. Do you recollect any such occurrence in any plant of the Great Western Power Company of California?

A. Yes, the plant of the Great Western Power Company at Big Bend, on the Feather River; very unsatisfactory operation as regards constant speed and frequency of the alternating current was corrected by introducing the by-pass valve operated inversely by means of a governor with the main gate valve of a 10,000 kilowatt generator.

Q. 716. Do you remember when this change of installation took place?

A. I don't remember absolutely now what year.

Q. 717. Were such by-pass valves, or were they not of the balanced frictionless type?

A. They were of the balanced frictionless type.

Q. 718. And were they or were they not operated from the governor?

A. They were operated from the governor, yes, sir.

Q. 719. I now show you a blueprint, and ask you if you can state generally what is disclosed therein?

A. This blueprint discloses a diagrammatic, or what might possibly be called a perspective or birdseye view of a portion of the generating and transmission system of the San Joaquin Light and Power Company in the vicinity of Fresno, Bakersfield, etc., wherein are shown three water power plants operating together on the main transmission line. These water power plants being, first, that of the Power Development Company near Bakersfield; second, of the Crane Valley plant of the San Joaquin Light and Power Company and, third, what is known as plant number three of the San Joaquin Light and Power Company. And also upon this same system a steam generating plant in Bakersfield. I am personally familiar with the details of the construction and operation of this plant. The distinguishing feature is that the governing or maintaining of constant speed at all loads is accomplished primarily at one plant, namely, the Crane Valley plant; this hydro-electric plant being equipped with the type of governing device in accordance with the disclosures of the Lyn-

don patent, and essentially as set forth on blueprint KKK, wherein the water gate is operated inversely and simultaneously and positively with the by-pass valve. The plant of the Power Development Company is manually operated, and is not used for governing at all. Under some circumstances the same is true of the steam plant at Bakersfield, although the steam plant is not operated as continuously as the water power plants, it being desirous of saving fuel under those conditions.

Q. 720. What results in the use of this general system with respect to the joining together of the several stations or plants, and the result and control of the same?

A. As in this system of the San Joaquin Light and Power Company, the general practice now is to operate a number of hydro-electric plants, and in some cases steam plants in parallel, as we say, or upon the same general transmission system, it being possible therewith to have all the governing to maintain constant speed with varying load at practically one plant, insuring the use of all the water available at all of the other plants; the advantage, of course, being that if the responsibility for the governing for constant speed at variable load is successfully carried out at one plant, the governing mechanism in one plant serves the purpose of all of the plants, it may be, that are so connected in parallel. This is common practice at the present time, and is very advantageous to the operation of hydro-electric plants and the obtaining of the maximum efficiency from

the water power available, and converting this water power into electrical power.

Q. 721. Is it or is it not, therefore, proper to say that the Power Development Company plant represented in the system as shown by this blueprint is, in effect, or ultimately governed, due to the direct governing which takes place in the Crane Valley plant, and which affects the system including this Power Development Company plant?

A. Yes, sir, all of the governing of the generating plants, including that of the Power Development Company, is accomplished at one plant, namely, the Crane Valley plant.

Q. 722. And that governing is accomplished, is it, or is it not, in accordance with the disclosures and teaching of Complainant's Exhibit A, copy of London patent in suit?

Mr. Westall: The question is objected to as calling for a conclusion of the witness, and not calling for any proper comparison by which the Court can determine whether the conclusion is correct.

A. Yes, sir.

Q. 723. (By MR. BLAKESLEE:) I understand you to say that the general scheme of governing there as to specific details is substantially in accordance with the governing installations of the defendant's alleged infringing structures as exemplified, for instance, in Complainant's Exhibit KKK?

A. Yes, sir.

Mr. Blakeslee: We offer in evidence the blueprint just discussed by the witness, as Complainant's

Exhibit Diagram of System of Control and Circuit, including Power Development Company's present plant.

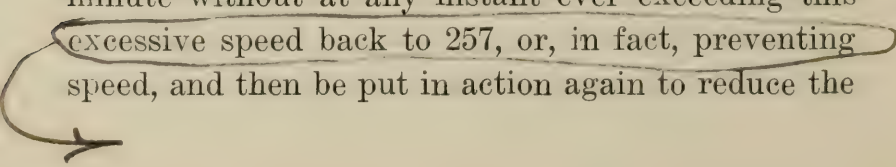
Counsel may now cross-examine the present witness, subject to brief recall for further direct examination.

CROSS-EXAMINATION

Q. 724. (By MR. WESTALL:) Will you please describe as briefly and in as untechnical language as possible what is meant by overrunning, or hunting, when such words are used in describing the operation of a water-wheel governor?

A. When a water wheel is running at what we call normal speed, other things being equal, such as the head of water, if the demand for power from the generator which is being driven by that water wheel is increased, or, as we commonly say, if the load is increased, there will be a tendency instantly, for the speed of rotation of the water wheel to drop. Conversely, if the load is decreased upon the electrical generator, due to the service in electric power which is being rendered from the service connected to the electric generator, there will be instantly a tendency for the speed to rise, as the result of a reduction in the load. Now, it is imperative and absolutely necessary for good electric power service, particularly when alternating current is used—and alternating current is almost exclusively used for large power generating systems—that the speed in revolutions per minute shall remain just as nearly as possible

constant. The function of the water wheel governor, or speed governor, is to hold that speed as nearly as possible constant, no matter what may be the changes in load upon the generator, within very wide limits. Let us consider that the load is suddenly increased on a water-wheel-driven generator: the tendency will be at once for the speed to drop. The governing mechanism has for its object the increasing of the amount of water on the wheel, to bring the speed back to normal; but unless the governor is of the proper modern type, it will allow more water to come on the wheel than is really required by the increased load, with the result that the speed will be increased from below normal to decidedly above normal. Then the governor acts again to reduce the speed, and in so doing it will reduce it down below where it should be. That is called hunting, or fluctuation of speed above and below normal. The modern governor—and the only one that is at all satisfactory at the present time—is one which will bring about the result of bringing the speed back to normal without exceeding the normal, or being less than normal. To use the illustration where the normal speed of a generator is 257 revolutions per minute, if the load is increased upon the generator the speed might drop to 254 revolutions per minute. Now, if a satisfactory governor would gradually, and as soon as possible bring this speed back up to 257 revolutions per minute without at any instant ever exceeding this excessive speed back to 257, or, in fact, preventing speed, and then be put in action again to reduce the



the speed seesawing successively above and below the normal speed, which, in this case, we will assume to be 257 revolutions per minute.

XQ. 725. Might it be said briefly that this seesawing which you have described is what is called governor hunting or overrunning?

A. Yes, sir.

XQ. 726. The word "hunting" seems to be a rather peculiar word to be applied to overrunning, Would you explain why, if at all, you think it correctly describes the action of such governor?

A. The word "hunting" in this connectoin is unquestionably used because of the similarity of the action with the alternating current generator when it is operating as a synchronous motor, that a synchronous motor will tend to what might be called "hunt" its normal speed, and in so doing will run first too fast, and then too slow, an so on, until it finally settles down to what ought to be its normal speed. The word "hunting", I am sure, was introduced in connection with the use of an alternating current generator used as a synchronous motor, and naturall got applied to the same phenomenon in the operation of either water-wheel-driven generators, or steam turbine driven generators, or steam engine driven generators, or gas engine driven generators, or any kind of driving of electric generator.

XQ. 727. The word "seeking" might also be an appropriate term, might it not, in that it conveys the idea of the mechanism endeavoring to adjust itself to a certain set of conditions? Is that correct?

A. I should say seeking the normal speed.

XQ. 728. Do I understand you correctly as having stated upon direct examination, in effect, that a returning device is a mechanical element or combination of elements designed to prevent a governor from overrunning?

MR. BLAKESLEE: The question is objected to as calling for the witness's conclusion, and as being argumentative and attempting a definition in the question, rather than by answer.

A. Yes, sir.

XQ. 729. (By MR. WESTALL:) Would you say that such a returning device was an indispensable part of every governor?

A. I should say absolutely indispensable for every water wheel governor; because, as soon as the governor acts there is a change in the velocity of the water in the pipe line, and the returning device is absolutely necessary to act so as to slowly restore the normal velocity ~~in the pipe line~~ for any given load. A returning device in my experience is absolutely necessary for satisfactory governing, to take care of the inertia of the water in the pipe ine.

XQ. 730. Please describe briefly how a governor not supplied with such a returning device would operate?

MR. BLAKESLEE: Objected to as calling for mere repetition of testimony extensively given, in which the art has been fully exploited with respect to the objectionable features of governing without

the use of such returning device; and not proper cross-examination.

A. A governor not supplied with such returning device would, as the result of the change of speed, due to change of load, or due to change of pressure in the pipe line, increase or decrease the supply of water to the wheel. It would be in my opinion impossible to bring back the speed to normal without such returning device, without overrunning, or causing the seesawing we speak of; because immediately that you increase the opening to the wheel you diminish the pressure at the nozzle, because the column of water cannot follow as rapidly as the demand is caused by the increased opening; in other words, the governor will overrun. Now, after the readjustment of speed has finally been accomplished, either properly or improperly, we have got a different amount of water being delivered to the wheel as a result of the change of load, and you must return the by-pass, if there be one, or the water gate if there be one, to just the right position for this new condition. If you haven't any such returning device it is inevitable that you will have the seesawing or seeking, or hunting, or fluctuation, above and below normal, of the speed, because the returning device prevents the governor from overrunning or exceeding the movement which is necessary to restore normal speed.

XQ. 731. (By MR. WESTALL:) You have stated that the mechanism of defendant's exhibit Lamb patent has no returning device. Do you mean

that there are no means in the device of the Lamb patent referred to for preventing overrunning, or hunting?

A. If the Lamb patent were in reality what the inventor thought he was disclosing, the total amount of water would never vary. Part of the water is used to increase the speed, and the other part of the water to diminish the speed. In that sense it might be said, I think, that the Lamb patent, if it would operate as the inventor seems to think it would, would regulate for constant speed at any load. But, as has been shown, the water gate without in any way effecting the gate which he calls the brake water gate. So that in my opinion it would never operate; in fact, it is absolutely ^{ineffective} ~~imperative~~ as disclosed in the patent, for the regulation of constant speed.

XQ. 732. Did I understand you correctly as testifying that you find no mechanism disclosed in Defendant's exhibit Swiss patent for preventing the governor from overrunning or hunting?

A. No, sir, there is no such device in it.

XQ. 733. And is it your understanding of the construction therein disclosed, that the governor would overrun?

A. Yes, sir.

XQ. 734. And is your testimony the same with reference to defendant's exhibit French patent in suit?

A. Yes, sir.

XQ. 735. Referring now to defendant's exhibit

Berry blueprint No. 1, I will ask you how much time you had, previous to your testifying in this case concerning the construction illustrated in said blueprint, to study and familiarize yourself with the devices and disclosures of said blueprint?

MR. BLAKESLEE: Objected to as immaterial, the witness having testified that he understood the disclosure of this blueprint.

A. I had about two hours to go over this blueprint, but I was absolutely familiar with the misconception which the engineers had of this device at the time it was put in, and was familiar with its failure, and have often discussed it with various engineers, including Mr. Cobb, himself.

XQ. 736. (By MR. WESTALL:) Are you speaking now of the failure of the wheels to develop the required horse power, or of the governor mechanism?

A. Both.

XQ. 737. Did you put in two hours studying the blueprint referred to before testifying in this case?

MR. BLAKESLEE: The same objection as last noted.

A. Approximately two hours, yes, sir.

XQ. 738. (By MR. WESTALL:) I notice that you hesitated a considerable time before attempting to describe certain parts of the mechanism of said Defendant's Exhibit Berry blueprint No. 1, particularly the manner and place of connection of the water wheel shaft and the generator shaft, and that counsel for the complainant and Mr. Henry at that

time made certain informal suggestions not noted of record, which apparently enabled you to describe the construction. I will ask you if you are quite sure you understand the nature, operation and effect of the various devices illustrated in said blueprint?

MR. BLAKESLEE: Objected to as improper conduct on the part of counsel, and merely argumentative and not cross-examination; merely an attempt to slur the testimony of the witness and manifestly improper inasmuch as it attempts to inject something into the record which was not injected, if it might have been in fact, at the point in the record concerned.

A. I am very sure that I understand the method of connection and operation of the so-called Girard governor which is really a power transmission dynamometer as shown on Berry Blueprint No. 1. The only reason I hesitated was because I recalled at the time that it was installed incorrectly by the engineers when they first put it on. It was later on pointed out to them by other engineers, and I did not know whether this was a correct drawing, or an incorrect one.

XQ. 739. (By MR. WESTALL:) You are sure, then, that you would have understood the construction without any suggestion from Complainant Henry, or counsel for complainant, if you had been given a few moments to study the matter?

MR. BLAKESLEE: The same objection. We protest that this method of talking in the air about

something that is not of record, and which is without proper foundation at all.

A. I am quite sure I should, because the device is a simple power transmission dynamometer, and I have used them for purposes of measuring the amount of power transmitted an innumerable number of times in the past fifteen years.

XQ. 740. (By MR. WESTALL:) In describing certain parts of the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 you stated that the plug-cock or body within the casing—this body, apparently, being numbered 46——

THE WITNESS: It is 41.

MR. BLAKESLEE: We wish to have the record show that counsel himself does not apparently understand the construction of the blueprint shown him.

MR. WESTALL: Counsel admits that he did not, owing to the folding of the paper. He supposed that the "1" of the figure referred to was a "6".

MR. BLAKESLEE: Objected to as argumentative.

(The reporter read the last question.)

XQ. 741. (By MR. WESTALL:) Was supported on one end by a bearing 41. I will ask you if you were referring to the actual structure that said Berry Blueprint No. 1 is said to illustrate or merely the device illustrated in said blueprint.

MR. BLAKESLEE: Objected to as embodying an inaccurate quotation.

A. I was referring to the Berry blueprint No. 1.

XQ. 742. (By MR. WESTALL:) How do you know what the stop-cock body (or, perhaps, we can say plug) within the casing is supported on one end by a bearing 41?

A. Well, what would lead any one to say that such was the case was the disclosures of figure 2 of Berry Blueprint No. 1 especially.

XQ. 743. Do the drawings of said figure 2 show a bearing at the point referred to?

MR. BLAKESLEE: Objected to as not calling for the best evidence; the blueprint speaking for itself so far as it goes.

A. The drawing shows the method whereby the cylindrical plug-cock of the valve is rotated by the so-called governing mechanism, and the outline of the plug-cock in dotted lines in the inlet pipe 46, which is fitted with a by-pass pipe 44-45

XQ. 744. (By MR. WESTALL:) And those details are sufficiently clear for you to be quite sure of your conclusion?

A. The details are clear enough to indicate very clearly that this cylindrical plug-cock is supported—whether you choose to call it a bearing, or a journal, or a shaft, or what not—on one end only.

XQ. 745. During your direct examination you did not state whether said Defendant's Exhibit Berry Blueprint No. 1 disclosed the body of the plug or stop-cock illustrated at 41 and 42, and referred to in the immediately preceding questions, "supported at its "end opposite said bearing 41". Do I understand you as meaning to imply that you do not find such

support for the end of said body of the plug or stop-cock cylinder at the end opposite bearing 41?

MR. BLAKESLEE: Objected to in so far as it misquotes the testimony, and as being merely argumentative and not cross-examination.

A. I do not find any support for the plug-cock 41 except upon one end as disclosed by the blueprint.

MR. WESTALL: XQ.746. You have testified that you found no indication on the part marked "J" of this Exhibit XX, of the part marked "A" in red pencil on Defendant's Exhibit Berry Blueprint No. 1. Please state what kind of an element or device you looked for on the part marked "J" in making such a comparison?

A. I looked for a bearing or support on the opposite end of the plug-cock type valve.

XQ. 747. Why did you look for such a bearing?

A. Because I desired to find out whether any was shown on Defendant's Exhibit XX" in the part marked "J".

XQ. 748. You assumed then, did you not, that the part marked "A" in red on Defendant's Exhibit Berry blueprint No. 1 was intended to indicate a bearing at the other end of said plug-cock cylinder?

MR. BLAKESLEE: Objected to as argumentative.

A. No, I did not have any idea that the red letter "A" on Berry blueprint No. 1 definitely or positively one way or the other represented that there was a bearing.

XQ. 749. (By MR. WESTALL:) Did you as-

sume that that might be the purpose of the dotted lines illustrating the construction shown at "A" in red on said defendant's exhibit Berry Blueprint No. 1?

A. Yes, sir, I so considered that it might be.

XQ. 750. As a matter of fact the dotted lines shown at said capital "A" in red on the last-mentioned exhibit could hardly be intended to represent anything else than that there was a bearing at the other end of the plug-cock cylinder, could it?

MR. BLAKESLEE: Objected to as merely argumentative and calling for a conclusion on the part of the witness, which is not the best evidence; the blueprint speaking for itself; and not proper cross-examination.

A. I would not conclude that the dotted lines necessarily indicate a bearing; they might indicate a cap over the end without any bearing at all.

XQ. 751. (By MR. WESTALL:) You have pointed out very positively a bearing 41 supporting the plug or stop-cock cylinder of the by-pass valve of defendant's exhibit Berry Blueprint No. 1. Do you mean to say that a trunnion or shaft supporting the other end of said body or plug of the stop-cock cylinder of said exhibit does not appear with equal clearness in said blueprint at the point indicated by the letter "A" in red thereon?

MR. BLAKESLEE: Objected to as placing an arbitrary interpretation on the testimony of the witness and as merely argumentative, and not cross-examination.

A. No, sir, it does not.

XQ. 752. (By MR. WESTALL:) Is it not very reasonable to suppose that the dotted lines shown at the part marked "A" in red on Defendant's Exhibit Berry Blueprint No. 1 were intended to indicate that the end of the plug-cock body was supported on a shaft or trunnion at the point indicated?

MR. BLAKESLEE: Objected to as merely argumentative and this is not the time to prove defendant's case, and if defendant has omitted to make out his case in connection with his own witnesses as to this blueprint produced by him and purporting to be made by one of his experts, he cannot now attempt to obtain evidence as to such showing.

A. I don't think so.

XQ. 753. (By MR. WESTALL:) Would not the support of the stop or plug-cock valve body at both ends be a very obvious remedy for any friction between the body of the plug-cock and its casing, supporting, as it would, the body of the plug-cock out of contact with its casing?

MR. BLAKESLEE: Objected to as merely argumentative.

A. It would not be a remedy for friction at all; it would merely tend to keep the plug-cock in line with its casing; but as obviating friction, any one experienced in plug-cocks knows that it would not do so; that the friction would result from small particles of sand, grit and foreign matter getting into the rotating valve, and the pressure in this case would be so great as to probably deflect and bend any

shaft that you could put in there, sufficient to make the valve inoperative on account of friction. In my experience I have never seen or known of a valve of this type being operative, whether it had a shaft extending clear through it and supported on both ends, or simply supported on one end, where the size of the valve is as large in proportion to the remainder of the mechanism as is shown on Berry Blueprint No. 1.

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XQ. 754. (By MR. WESTALL:) The principal difficulty, then, you believe in preventing the successful operation of such a valve would be the sand, silt, that would accumulate between the plug-cock body and its casing?

A. That would be one of the principal difficulties. There are other principal difficulties, such as the very large contact area between the movable or cylindrical part of the valve and its casing, which must fit tight enough to prevent excessive leakage, and also due to the fact that this type of valve, which, when it opens, does not leave its seat, but there is a constant friction which must be overcome, between the movable exterior surface of the cylindrical plug-cock and the surface of the valve seat or case, which friction continues at all times, whether the valve is closed or open, or fractionally open.

XQ. 755. Suppose that water used with such a plug-cock valve as you have been referring to was clear and free from silt and sand, would you still say that such a valve would necessarily be unsuccessful

in its operation, provided, of course, that the body portion of such valve was supported at each of its ends by trunnions or by a shaft extending through it and upon which it rotated?

A. I should say that the fact that the water was absolutely clear and free from any grit or foreign substance would reduce the friction effect, particularly as to this friction varying at different times; but it must be remembered in this valve that its diameter is about one-fifth of the diameter of the wheel itself, and it is so large, and the pressure of the water upon it so great that it is absolutely impossible to eliminate excessive friction and still keep the valve tight, even if the cylindrical plug-cock were mounted upon a shaft, and this shaft supported in suitable bearings on both ends.

XQ. 756. Assuming that the part marked "A" in red on Defendant's Exhibit Berry Blueprint No. 1 is intended to indicate that the body of the plug or stop-cock valve is supported by a trunnion at that end, and that the other end is supported by the shaft 41, as pointed out by you, it is a fact, is it not, that the body of the stop or plug-cock valve, if made sufficiently loose, could rotate freely in its casing, without any friction whatever?

MR. BLAKESLEE: Objected to as merely hypothetical and immaterial, particularly in view of the fact that the blueprint in question shows the plug-cock in intimate contact with its seat, being the best evidence.

A. I should answer the question by saying that

if that shaft only were placed in that pipe, and there was no cylinder whatsoever, that the friction caused by the pressure of the water on that cylinder would be so great as to cause considerable friction.

MR. WESTALL: XQ. 757. That is to say, providing nothing but a shaft extended through it?

A. Yes, because of the very large size of the valve.

XQ. 758. Would the operation be any different if you would connect to that shaft the two wings of a butterfly valve—in other words do you mean to say that the connecting to that shaft extending through there of two opposite wings of a butterfly valve would reduce the friction in any respect?

A. No, it would not reduce the friction; but the wings of a butterfly valve would tend to balance the effect on its two sides, and there would be merely the friction of the shaft upon its small bearings, and this would be effectively overcome by the balancing effect of the flow of water through the partly opened butterfly valve. It must be remembered in connection with all of this testimony that the serious effect of friction is due to sticking of the valve when it is at rest, and the overcoming of this friction from the time the valve is at rest to putting it in motion, thereby delaying and most seriously affecting the efficiency with which the speed is restored to its normal amount.

XQ. 759. So if I understand you correctly, if the shaft alone extended through such a plug-cock valve, leaving the body portion out entirely, the friction

at the bearings at the end would be excessive and would interfere with the rotation of such a shaft, but that if a butterfly valve were mounted on such shaft, the friction at the ends of the trunnions or shafts would be reduced by the butterfly valve?

MR. BLAKESLEE: Objected to as argumentative and not cross-examination, being purely hypothetical, and not calculated in any way to prove any issue in this case, and being contrary to the disclosures of the blueprint in question.

A. No, sir, I have not testified, nor have I said anything whatsoever that could be construed to indicate that there is excessive friction resulting from the shaft itself operating in its bearings.

XQ. 760. (By MR. WESTALL:) There would not be any more friction if such a shaft were located in the position just referred to without a butterfly valve being attached to it, than there would be with such a butterfly valve attached to such shaft, would there?

A. No, sir, it would make no difference whatsoever in the friction which would be produced between the shaft and the bearings of the shaft, whether it had a butterfly valve put on it, or not.

XQ. 761. As a matter of fact there would be more friction with a butterfly valve or anything protruding from the sides of that shaft than there would be without such protuberance?

A. No, sir, it would be no greater friction as far as moving the valves from one position to the other, whether it had a vein or a butterfly on it, or not, be-

cause there is absolutely no movement of the surface of the butterfly valve over a fixed surface; it simply rests down against the seat the same as a book lies upon the table. When the butterfly valve is opened it corresponds to lifting the book from the table.

XQ. 762. If the body of this plug-cock valve were supported at both its ends as disclosed in the immediately preceding questions, all that you said about the pressure of the water causing friction between the body of the valve and its casing (providing, of course the valve body was made sufficiently loose so as not to contact with its casing), would not be applicable to such a construction, would it?

MR. BLAKESLEE: Objected to as merely argumentative and hypothetical and not proper cross-examination.

A. The area exposed to pressure on the surface of the cylindrical plug of the valve, as shown in Berry Blueprint No. 1, is approximately eight times the area which is exposed for friction between the shaft and its bearings, and it is certainly very clear that inasmuch as the water pressure exerts a certain number of pounds pressure per unit of area, that the large area of the valve itself will cause a greater effect due to friction from this pressure than if we are considering only that of the shaft itself; the difficulty being with this valve, the very large area on the surface of the cylindrical plug subjected to the water pressure.

XQ. 763. (By MR. WESTALL:) And to what extent would you say that the water pressure upon

the large body of this valve, eliminating any question of friction with the casing, would interfere with the turning of the valve upon its shaft or trunnions?

A. The water pressure on the surface of the valve would, as I have stated in the last answer, increase the friction of the bearings, but the most serious friction, of course, results from the contact between the cylindrical rotating plug and its casing, this contact being sufficiently close to be water tight, or reasonably water tight under the pressure used at the plant.

XQ. 764. And do you believe that such water pressure, with the assumption made in the last question, that the plug does not come in contact with its casing, but is supported by a shaft or trunnion, is sufficient to prevent or seriously interfere with the turning or operation of the valve, assuming that the hearings are properly fitted and made?

MR. BLAKESLEE: The same objection as last noted.

A. I not only think so, but I know it from actual experience and an attempt to use such valve for the purpose indicated in Berry blueprint No. 1.

XQ. 765. (By MR. WESTALL:) That is to say you have had actual experience in using a valve, the body portion of which was supported at both its ends by a shaft or by trunnions, said body portion being made sufficiently loose so that it did not contact with its casing, and said valve body being as large comparatively as that illustrated in said Defendant's Exhibit Berry Blueprint No. 1?

A. Yes, sir, and I wish to make clear that my experience has been with a valve which actually was successful in stopping water when closed. Your question is unreasonable in that you state that the cylindrical plug does not in any way touch the casing, which is manifestly impossible, if it prevents water from flowing through the valve and leaking. There must be contact between the outer casing and the interior cylindrical plug, if it acts as a valve at all.

XQ. 766. It is true, is it not, that a butterfly valve, such, for instance, as is illustrated in Complainant's Exhibit A, might perform in a satisfactory manner its functions without coming in actual contact, when closed, with the pipe in which it was placed?

A. Yes, sir, as a matter of fact no butterfly valve that operates ever does come in contact on its outer edge with the pipe, but merely rests upon its seat, exactly as I have attempted to illustrate, as a book lies down upon a table; and the opening of the butterfly valve introduces no more friction than is introduced when you pick up a book from the table and lift it vertically upward.

XQ. 767. When you say that a butterfly valve rests upon its seat, what seat do you refer to?

A. The seat is a shoulder or projection on the inside of the pipe. The tightness of the valve does not depend at all upon the outside rim of the butterfly valve touching the interior of the pipe at all; its tightness depends absolutely and solely upon there

being reasonable continuity of surface between the seats of the butterfly valve and the seat of the valve.

XQ. 768. Do I understand you to say that this projection or seat extends entirely around the inside of the pipe so that when the butterfly valve is closed it rests against such a seat?

A. Practically so; not necessarily entirely, but practically so.

XQ. 769. Referring to Complainant's Exhibit Lyndon patent in suit, I will ask you to please point out in the drawings, or anywhere in the specification where any such seat is shown or described?

A. I think there is none so shown in the patent.

XQ. 770. So that so far as Complainant's Exhibit A is concerned, the valve therein shown would allow a considerable leakage of water by reason of its want of contact with the pipe, and by reason of the failure to provide or show any seat. Is that correct?

MR. BLAKESLEE: Objected to as being merely argumentative; the patent speaks for itself.

A. The valve is only shown in the diagrammatic drawing of figure 1. However, beginning with line 74 on page 4, the specification of the Lyndon patent states, "It is obvious that the by-pass, arranged as described, opening or closing in a manner opposite to "that in which the main gate opens or closes will, if properly" adjusted, admit of the main gate being rapidly operated and the "governing of the water wheel quickly accomplished." It is impossible to rapidly operate a plug-type valve when it is started

from rest. Again, quoting from line 80, page 4, "after the governing takes place the by-pass gate is either open or closed," or nearly so, and in order to be useful for a second "governing must return to its normal position." Now, no valve of this type can be closed, in the proper meaning of that word, without being provided with seats upon which to rest. In other words, it is not like a damper in a stovepipe, but actually is so constructed as to close, and prevents the passage of water when it is closed; but this condition of being closed and absolutely preventing the passage of water does not introduce any friction whatsoever at the instant that it is opened, because here is no rubbing of surfaces together.

XQ. 771. (By MR. WESTALL:) But ~~do~~ you not find anywhere in the patent any reference to a seat, or any illustration of a seat to be used with such butterfly valve?

MR. BLAKESLEE: Objected to as calling for the witness's conclusion and not the best evidence; the patent speaks for itself.

A. No, sir, I do not; but I definitely find the statement that the valve is closed, preventing the flow of water through the by-pass.

XQ. 772. (By MR. WESTALL:) It might be proper to say that a stovepipe damper was closed even though there was a slight space left around the periphery of such damper, might it not?

MR. BLAKESLEE: Objected to as merely argumentative and not a proper method of cross-examination.

A. To people who make stovepipes and that class of apparatus, yes, but to people who make valves that are to be tight under pressures of water up to a thousand pounds, I do not think that would be at all a sensible statement.

XQ. 773. (By MR. WESTALL:) It is a fact, is it not, that the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 is so designed as to allow a constant waste of water while operating under normal conditions of speed and load, is it not?

A. It may be, but the way in which the blueprint is shown, the valve is shut.

XQ. 774. Do you understand that such device is capable of an adjustment by which its normal position would be closed? I am speaking of Defendant's Exhibit Berry Blueprint No. 1.

MR. BLAKESLEE: Objected to as indefinite; no valve is specified.

A. I don't think it would be operative under any condition, whether the normal position of the by-pass valve were entirely closed, or partially open; but that would be quite immaterial, as to whether it was partly opened, or closed. It would be more difficult to operate the valve when it was entirely closed, however, than if it were partially opened, simply because if the valve were partly open the surfaces causing excessive friction would be somewhat reduced in area.

XQ. 775. (By MR. WESTALL:) When you say that you do not consider that it would be operative under any conditions, do you mean to say that you believe that the device would actually not work for any reason?

A. Yes, sir.

XQ. 776. Or not operate?

A. Yes; and to make that clear I will indicate a case. If the device shown on Berry Blueprint No. 1 was in operation at a given constant load upon the generator, and at normal speed, and for any reason the pressure in the pipe line should be reduced, such as a failure of the water to run into the pipe line from the forebay sufficiently rapidly, notwithstanding the fact that the speed and the load remained constant both, the mechanism in its operation would actually interfere with the constant speed, as a result of the reduction of the head disturbing the operation of the plant. That is the reason why I say that it would be absolutely inoperative in practice; because it is manifest that what is desired is constant speed, and even if the speed should remain constant because the load is constant, a reduction of the pressure of the water on the wheel, due to the action of the transmission dynamometer, which transmission of power from the water wheel to the generator, as shown in figure 1 of Berry Blueprint No. 1, would disturb and interfere with the normal operation, and tend to increase the disturbance caused by the reduction in head. That is the reason why I wish most definitely to be understood as saying that the device in its entirety, including the power transmission dynamometer, figure 1, the mechanism connecting this device with the plug-cock valve, all are inoperative in regulating for constant speed, even if the load does stay constant.

XQ. 777. When you say that the device of the plug-cock valve is inoperative, you do not mean thereby to

say that it is incapable of being moved in its seat, and of allowing the water to escape through it, and shutting off the water; assuming, of course, that such valve is supported by a shaft or trunnions, and is made to fit so loosely as not to come in contact with its casing?

A. I do not mean to say that the plug-cock valve is incapable of being moved, but I do wish to be understood as saying that its construction is such as to be incapable of being moved from rest with sufficient ease and quickness to accomplish any satisfactory result in the moving of a water-wheel and generator at constant speed. And I further wish to say that while the valve may be operative, it would be absolutely impossible—and this is confirmed by Mr. Cobb's tests—to regulate the speed without causing serious seesawing or hunting of the speed, first, we will say, above normal, and then below normal, rather than bringing the speed down, we will say, to normal without first going below normal, and then seesawing back and forward. Considering a thing inoperative is entirely a different thing from considering it operative for the purpose for which it is built. An automobile may be operative if enough men get behind it and push it, but if there is a serious defect in the engine it is not operative in the sense that it is supposed to be a self-propelling vehicle.

XQ. 778. If you were told by those who had actually seen the plug or stop-cock valve illustrated in Defendant's Exhibit Berry Blueprint No. 1, and had witnessed its operation, that after being filed down a little it worked perfectly, would you or would you not be driven to the conclusion that both ends of the body of

this stop-cock valve were supported in some way so as to obviate friction of said body with its casing, or that the friction between the valve and its casing did not have the effect you described on your direct examination?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination.

A. It is impossible for me or any one else to answer your question unless you explain more fully what you mean by the valve working perfectly.

MR. WESTALL: (XQ. 779). I mean by that that it performs the functions of its design perfectly?

MR. BLAKESLEE: The same objection.

A. Well, with my knowledge of the ^{power}proper transmission dynamometer and the attempt to use it as a speed regulating device—

XQ. 780. (By MR. WESTALL:) I am speaking more particularly of the valve.

MR. BLAKESLEE: I object to the interruption of the witness.

(The reporter read the answer of the witness.)

THE WITNESS: (Continuing:) It would make no difference what information was given me; I would be absolutely certain that it could not work perfectly in connection with the plug-cock valve in regulating the water wheel and generator at constant speed with variable load. If, however, you restrict your use of the word “perfectly” to the valve itself, independent of the rest of the so-called governing mechanism, I would assume that the cylindrical body of the plug-cock valve might have been filed down sufficiently so that it would work

perfectly backward and forward, opening and closing, whether or not it had a shaft extending entirely through its body with bearings on both ends, or not.

MR. BLAKESLEE: I move to strike out the answer on each of the grounds stated in the objection to the question.

XQ. 781. (By MR. WESTALL:) Have you any reason for any positive belief that the part marked "A" in red on Defendant's Exhibit Berry Blueprint No. 1 is not intended to indicate that the end of the body of the plug-cock valve opposite its bearing 41 is supported by a trunnion or extension to the shaft resting in the bearing 41?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination, and an attempt to prove on cross-examination of complainant's witnesses what defendant apparently could not prove in connection with this, its own exhibit, by means of its own witnesses, and when offering this exhibit in evidence; and as not calling for the best evidence.

A. Yes, I have reason to believe that it is not so intended, because it is not so drawn. If the shaft 42 were supposed to extend entirely through the plug-cock, it would be so shown by dotted lines throughout the entire length of the cylindrical stop-cock, and it is not so shown at all in the drawing.

XQ. 782. (By MR. WESTALL:) I don't believe you have fully answered the question, which also refers to the part "A" as being possibly intended to indicate a trunnion?

A. I may be able to answer that question if you will define what you mean by a trunnion.

MR. WESTALL: I will state that I am not an expert in mechanics, and therefore I leave the definition of technical terms to the experts, and inasmuch as the expert, the present witness, has used the term "trunnion" on several occasions, and has answered questions in which said word was used, I will ask the witness to please define the term "trunnion" as he understands it.

A. I have not used the word "trunnion" except in answer to questions where you used the word "trunnion", and when I have so answered it I have considered it as synonymous with the word "bearing", because no other interpretation of the word "trunnion", as you have used it, is possible in the context of your questions.

XQ. 783. Will you kindly, without any particular reference to the manner in which I may have used it, define the term "trunnion"?

MR. BLAKESLEE: Objected to as not cross-examination, and on the further ground that the witness has qualified as an expert.

MR. WESTALL: Counsel for defendant suggests that the last part of the objection, namely, that the witness has qualified as an expert, is the very reason why counsel for defendant assumes that he is able to answer the question.

MR. BLAKESLEE: I will say that the only thing that could make the question material or competent would be to test his qualifications as an expert; otherwise it is not cross-examination.

MR. WESTALL: We have already sufficiently tested the qualifications of the witness as an expert, and are not raising that question at the present time; but hav-

ing attempted to qualify as an expert, we assume that he is familiar with the terms which have been used and which are used in this connection, and if he is not familiar with those terms, counsel believes that it should be discovered at this time.

MR. BLAKESLEE: The question is not cross-examination. The witness has testified that there is no trunnion shown in the exhibit; therefore, the question is improper and merely repetitious in effect, if it is connected in any way with the examination.

MR. WESTALL: The question is repeated, and the witness is asked to answer it.

A. A trunnion is ordinarily defined as the equivalent of a shaft, the only point being as to whether common use of the word "trunnion" does not in some cases include, in addition to the shaft, the bearing in which the shaft rotates. The word "trunnion" is sometimes used to indicate merely an extension or circular portion of what is otherwise a casing, and it is not a definite mechanical term such as the word "shaft" or "shaft and bearing".

XQ. 784. Assuming that I have used the term "trunnion" in my previous questions in which the word has been used, as a protuberance upon the end of the cylindrical body portion of the valve illustrated in Defendant's Exhibit Berry Blueprint No. 1, which rests in some sort of a bearing, I will ask you to please state whether or not you have any positive reason for believing that the part marked "A" in red on said blue print does not indicate such a trunnion?

MR. BLAKESLEE: Objected to as merely argu-

mentative and not cross-examination, and a further attempt to prove something by complainant's witness which counsel apparently could not prove by his own witness when this exhibit was offered.

A. I can only repeat my answer to a former question, which is practically the equivalent of this question, namely, that the blueprint known as Berry Blueprint No. 1, and the detail as shown in figure 2, does not show any bearing, or support or trunnion supported by the main pipe 46, inasmuch as the so-called protuberance referred to by counsel only extends to the inner surface of the pipe as shown by dotted line.

XQ. 785. (By MR. WESTALL:) Do you understand that this valve is placed in the main pipe 46?

A. It is placed below the main pipe 46, numbered below "No. 44", and then still further below "45".

XQ. 786. You stated that this part marked "A" does not appear to show any trunnion or protuberance having any bearing in the pipe 46. Will you also state that it does not indicate any bearing in the pipe below the pipe 46, in which you have just stated that the valve is located?

MR. BLAKESLEE: The same objection.

A. No, the drawing does not show any detail which can be construed as a bearing supported upon a fixed part, either in the pipe 44, or the casing 43, which is the casing of the so-called by-pass valve, and the outlet of the by-pass valve to the by-pass discharge pipe 45. I repeat that the drawing does not show any such trunnion or bearing supported by a fixed part except upon one end, and that is shown on figure 2, and indicated by the number 42.

XQ. 787. (By MR. WESTALL:) What, then, do you understand is intended to be illustrated by the part marked "A" in red on said Defendant's Exhibit Berry Blueprint No. 1?

MR. BLAKESLEE: Objected to as not calling for the best evidence; the blueprint speaks for itself; and it is not assumed that counsel contends that this witness is a better witness in this matter than his own witness previously introduced, and who testified that he prepared this blueprint. Therefore, the question does not call for the best evidence in two respects.

A. As it is drawn, it appears to ^{be} ~~me~~ intended to represent only the farther plate-covering of the casing of the plug-cock valve 43.

XQ. 788. (By MR. WESTALL:) Do I understand you correctly as testifying that the transmission dynamometer used as a governor in the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 is sensitive to changes of load and speed?

A. Yes, sir.

XQ. 789. It is, then, a speed-sensitive device as well as a load-sensitive device?

A. It is a speed sensitive device and a load sensitive device, but not in any sense a governor for constant speed.

XQ. 790. You have never seen the actual mechanism of the device illustrated in Defendant's Exhibit Berry Blueprint No. 1, have you?

A. Yes, sir.

XQ. 791. Where did you see that device?

A. I saw it down in a plant near Bakersfield.

XQ. 792. Did you observe its operation at that time?

A. No, sir, it had been taken out and discarded.

XQ. 793. When did you see it?

A. I saw it I should say about fifteen years ago.

XQ. 794. All of your testimony, then, as to how sensitive such devices might be, or how correctly the device referred to might provide for changes of load and speed, is based only upon theory and upon very brief study that you have been able to give defendant's exhibit Berry Blueprint No. 1 before testifying regarding it, as well as your examination of such device after it had been taken out, I believe you said fifteen years ago?

MR. BLAKESLEE: Objected to as calling for the witness's conclusion and placing an arbitrary interpretation upon the testimony of the witness, and not proper cross-examination.

A. My principal reason for testifying that it is absolutely inoperative as a device for maintaining constant speed at variable load is the construction of the device as shown by the drawing, as it is not a constant speed governor, but is a drawing of the well-known type of transmission power dynamometer, the use of which has been well known for at least twenty-five years. I also have what might be called hearsay knowledge of the failure of the device from the engineer, Cobb, and also the engineer, Mr. A. M. Hunt, who was called in to settle the difficulties and who immediately had the device taken off or so connected that it was merely the equivalent of a solid coupling between the water wheel shaft and the generator shaft.

MR. WESTALL: We object to any such hearsay evidence, and move that the answer, so far as it incorporates that character of evidence be stricken out.

MR. BLAKESLEE: It is to be noted as part of this answer that the knowledge of the witness comes from at least one witness on behalf of defendant in this case, and therefore it cannot be said to be hearsay any more than the testimony of a witness in the case might be hearsay.

MR. WESTALL: That witness has already fully testified as to the construction and operation of the device, and his testimony is of record.

XQ. 795. It is true, is it not, that the by-pass valve of the device illustrated in Defendant's Exhibit Berry Blueprint No. 1 might be adjusted to occupy a half opened position under normal conditions of speed and load, and might be constructed or arranged to occupy a more widely opened position under such conditions?

MR. BLAKESLEE: Objected to as calling for the conclusion of the witness and not the best evidence.

A. It could be constituted to operate in any such position whatever from fully open to fully closed.

XQ. 796. (By MR. WESTALL:) Still referring to the device Defendant's Exhibit Berry Blueprint No. 1, I will ask you how the by-pass valve of said device is designed or intended to operate when the speed of the water-wheel is increased, and how said by-pass valve acts, or is intended to act when the speed of the water wheel is decreased?

A. Will you please qualify whether you mean speed of the water wheel is increased or decreased by change of the load, or by the action of the governor?

XQ. 797. I mean whether the speed of the water-wheel is changed for any reason whatever; you can make your answer sufficiently broad to cover such differences?

A. If the speed of the water-wheel is increased, due to a decrease in the load, the design of the by-pass valve is supposed to be such as to increase the amount of water going through the by-pass valve by opening the same, thereby reducing the amount of water delivered to the wheel, with the result that the speed would be thereby reduced, corresponding with the reduction in the load. On the other hand, if the load upon the generator were increased, it would cause a reduction in the speed of the generator, and the by-pass valve is supposed to operate in such a way as to reduce the amount of water going through it, and thereby increase the amount of water delivered to the wheel, with the effect that the speed would be increased as the result of the larger amount of water going through it.

XQ. 798. What do you understand to be the purpose and object of the by-pass valve in the device Defendant's Exhibit Berry Blueprint No. 1?

A. In general to facilitate the proper adjustment of the amount of water delivered to the water wheel with changes of load; the total amount of water coming down the pipe line being divided into two parts, one part doing useful work by going through the water wheel, and the other part being wasted on by-passed as a result of the opening of the by-pass valve.

XQ. 799. Is it not true that when the governor of the device illustrated in Defendant's Exhibit Berry

Blueprint No. 1 acts to close the main gate or gates, that the device will open more widely the by-pass?

A. It is supposed to do that but it will not do it.

XQ. 800. That is the purpose and intent of the structure, is it not?

A. Yes, sir, that is the purpose.

XQ. 801. If the main gate or gates of the device, Defendant's Exhibit Berry Blueprint No. 1 opened, what do you understand to be the effect upon the by-pass valve, assuming that the device is operative, or would operate as intended?

A. That would altogether depend upon whether there was an increase of load upon the wheel. This might follow very properly: with a sudden load upon the wheel the by-pass valve would be supposed to close up so as to increase the amount of water on the wheel; but if that increase of load upon the generator should at the same time correspond with an increased water pressure for any reason, the by-pass valve would stay shut, and the increased pressure of the water would make up for the increased load. The power transmission dynamometer as shown in figure 1, would not be affected at any time, providing the amount of power transmitted through it would be the same, even if the speed should very greatly increase at the same time that the load upon the generator would be decreased.

XQ. 802. Still referring to Defendant's Exhibit Berry Blueprint No. 1 I will ask you if you find means for operating the water gate or gates in either direction, towards opened or closed?

MR. BLAKESLEE: Objected to as not calling for

the best evidence; the blueprint speaks for itself.

A. Yes, sir.

XQ. 803. (By MR. WESTALL:) And you also find such means for both opening and closing said water gates, do you not?

MR. BLAKESLEE: The same objection.

A. Yes, sir.

XQ. 804. (By MR. WESTALL:) Do you find a by-pass for the water wheel?

MR. BLAKESLEE: The same objection.

A. Yes, sir.

XQ. 805. (By MR. WESTALL:) Do you find a valve controlling said by-pass?

MR. BLAKESLEE: The same objection.

A. Yes, sir.

XQ. 806. (By MR. WESTALL:) Do you find means connected to the water gate operating means and operating the by-pass valve inversely to the operation of the water gate or gates?

A. Yes, sir.

XQ. 807. Do you find those various things referred to in your last preceding three answers in a water-wheel governor?

A. No, sir, I do not; I find it in connection with a power transmission dynamometer and not a water wheel governor.

XQ. 808. Referring to 'Complainant's Exhibit 1A, do you find such combination of elements in a water-wheel governor?

A. Yes, sir; and by "water-wheel governor" I mean one, the sole function of which is to maintain constant

speed of the water-wheel and the generator which it drives, under all conditions of varying load, varying water pressure, etc.

XQ. 809. Do you mean to say that in Complainant's Exhibit A the means for operating the water gates in either direction are parts of the water wheel governor?

A. Yes, sir, I should say it might be technically said that it is a part of the water wheel, rather than the water wheel governor.

XQ. 810. Might it also be technically said that the means for connecting the water gate operating means and operating the by-pass valve inversely to the operation of the water gate, is found in the transmission dynamometer of Defendant's Exhibit Berry Blueprint No. 1?

A. No, sir, the power transmission dynamometer figure 1, Berry Blueprint No. 1, has nothing whatever to do with the inverse action of the water gate and the by-pass valve.

XQ. 811. Such transmission dynamometer and its connecting parts were used, as a matter of fact, or intended to be used, in the device illustrated in said Berry Blueprint No. 1, to control the operation of the water gate valves and by-pass valves, under varying conditions of speed and load, were they not, and were therefore used to perform the functions of a governor?

MR. BLAKESLEE: Objected to as calling for the conclusion of the witness, and not a statement of facts in cross-examination, particularly in view of the objection of counsel for defendant that the present witness never saw nor witnessed the attempted operation of the alleged governor.

A. Yes, sir, that was the supposition.

XQ. 812. (By MR. WESTALL:) So that it is as logical to say that “means for operating the water gate in either direction and the “by-pass for the water wheel, “and the valve controlling said by-pass and means connected to the water gate operating means and operating “the by-pass valve inversely to the operating of the water gate are contained in a device used as a water-wheel “governor,” when referring to Defendant’s Exhibit Berry Blueprint No. 1, as it is to say that such combination of elements are found in a water-wheel governor when referring to “Complainant’s Exhibit A”?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination.

A. No, the entire difficulty being that in Berry Blueprint No. 1 the so-called governor is not in any sense a governor for constant speed with varying load, while in the Lyndon patent, definitely and in every detail of the disclosure, it is set forth that the governor is a water-wheel governor for the purpose of maintaining constant speed, not only with varying load, but with varying water pressure. I want to be very clear upon this point: what do you call a water-wheel governor? What does it govern? Now, I am using the term “governor” with the understanding that it is a device for maintaining constant speed of the water-wheel with a variable load on the generator, and with a variable water pressure; and the device shown in figure 1 of Berry Blueprint is in no sense a governor of that kind; it is a governor which will be, through intervening mechanism, utilized for operating the water gates and a by-pass

valve, whenever any one of three things change, namely, speed, load or water pressure. In other words, the speed and the load may be absolutely constant, and still a reduction in the pressure on the pipe line will cause the by-pass valve to act and the water gate valves to act, and interfere with the satisfactory operation of the water wheel and generator at constant speed.

MR. WESTALL: XQ. 813. You do not mean to be understood, then, as saying that the words "water wheel governor", used in a broad sense, are not applicable to this power transmission dynamometer used as illustrated in defendant's exhibit Berry Blueprint No. 1?

MR. BLAKESLEE: Objected to as merely argumentative and not cross-examination.

A. If you will specify what is governed by your governor, I will answer your question. I want you to distinctly specify whether you are governing speed, or whether you are governing the load, or whether you are governing the water pressure.

MR. WESTALL: I will not attempt to specify as requested, for the reason that I do not consider myself competent as an expert to do those things. I will have to have the witness make all the comparisons and point out the method of operation, which I do not pretend to be expert in. So, therefore, perhaps I cannot answer the question.

MR. BLAKESLEE: It is evident that the question is not such as the witness can answer with any definiteness that would make it of any value for the purposes of this examination. The question is therefore objected to as indefinite and incompetent and irrelevant.

MR. WESTALL: I think the question can be made clear by future questions.

XQ. 814. You have described this transmission dynamometer as illustrated in defendant's exhibit Berry Blueprint No. 1 as being sensitive to changes of speed and load, and by reason of this sensitiveness, communicating by various mechanical means, to the water gates and by-pass valve this sensitiveness, and thereby, by certain mechanism, causing these water gates and by-pass valve to open or close. I will ask you if you do not understand, in a broad general way, that such operation could be referred to properly as water-wheel governing, or as regulating the speed of a water-wheel?

MR. BLAKESLEE: Objected to as misleading and incorrectly quoting the witness, and, in fact, contradicting the witness in his testimony as to "sensitiveness", and also as to the production of any results due to any function of this dynamometer; and also as indefinite.

A. Yes, I should suppose it could be referred to in that way.

XQ. 815. (By MR. WESTALL:) And then in that sense, at least, this transmission dynamometer could be referred to as a water-wheel governor?

A. No, sir, it could not.

XQ. 816. Will you please reconcile your last answer with one preceding?

A. This transmission dynamometer would be, as it is always used in the way in which it is so represented in figure 1, as a device to keep the amount of power transmitted from the water-wheel to the generator absolutely constant. That amount of power might be at

257 revolutions, and it might be that that same amount of power might be as high as 300 revolutions, or as low as 200 revolutions. I wish to be understood this way: that as long as the amount of power transmitted from the water-wheel to the generator remains the same, no matter what happens to the speed, the whole mechanism will remain stable. Now, that is not what is desired in a water-wheel governor. What is disclosed in the Lyndon patent is a complete operating mechanism, partly electrical, partly mechanical, which will immediately tend to bring the speed back to normal, no matter what it is which changes that speed. That is the only thing the speed, itself; it regulates the speed and tends to keep it constant. Now, there are certain things that cause changes of speed in a water-wheel driving a generator. The most common one is a change of load upon the generator. Another thing that will change the speed of a water wheel, even if the load remains absolutely the same, will be a reduction or an increase in the pressure in the pipe line. What I wish to be understood as saying is this: that the Lyndon disclosure is specifically and completely that of a governor for the purpose of keeping the speed of the water wheel constant. I wish further to be understood as saying that the power transmission dynamometer as shown in figure 1 of the Berry Blueprint No. 1 is not, and cannot be used, and the device never has been used—in fact, it has always been used for an entirely different purpose namely, measuring the amount of power transmitted in this case between the water wheel and the generator. It cannot be used as a governor for constant speed, and when you attempt to use it as a governor for constant

speed, no possible result can come about except the unsatisfactory operation of the combination, and very serious stresses and strain upon every part of the mechanism, ultimately breaking it. I want to be perfectly clear upon that point, that the Lyndon patent is specifically one for the regulation of the speed of a water-wheel at constant speed, no matter what the load may be, or what the water pressure is, or what other things may change, the disclosure as set forth, particularly in figure 1 of Berry Blueprint 1, is a device for measuring the amount of power transmitted between a water-wheel which produces the power and the generator which absorbs the power; and I wish also to be understood that as long as the amount of power transmitted by that dynamometer remains the same—no matter what the speed is—nothing will happen to the rest of the mechanism. That was the defect, and the reason it failed.

XQ. 817. It is a fact, leaving out of consideration the question of the operativeness or success of the device, that this transmission dynamometer and its associated parts as illustrated in Defendant's Exhibit Berry Blueprint No. 1, was intended to be used to regulate the speed of the water wheel, is it not?

MR. BLAKESLEE: Objected to as calling for a conclusion on the part of the witness, and not the best evidence; defendant having had its opportunity by its numerous witnesses who testified about this exhibit, to tell the Court what the intention of this creation was.

A. I presume so, as there could have been no other reason whatsoever for introducing it except to regulate for constant speed when the load upon the generator varied, or the pressure in the pipe line varied.

XQ. 818. (By MR. WESTALL:) There was no object in inserting it there to measure the power, was there?

A. I don't know that, at all.

XQ. 819. So that if your conclusions are correct concerning the operativeness of the device, you could properly say that it was an attempted water-wheel governor, or a water wheel governor which was not successful?

MR. BLAKESLEE: Objected to as argumentative only, and calling for a conclusion, and not the best evidence, and not proper cross-examination.

A. I should say it was an attempted water wheel governor for maintaining constant speed, or an attempt to use a power transmission dynamometer as a water wheel governor for maintaining constant speed.

XQ. 820. (By MR. WESTALL:) And the only reason you hesitate to apply the term "water-wheel governor" to the device illustrated in said "Defendant's Exhibit Berry Blueprint No. 1" is because in your opinion the device referred to was not operative, or was not successful as a water-wheel governor; is that correct?

MR. BLAKESLEE: The same objection.

A. No, sir; my reason for saying that it is not a water-wheel governor is that that particular device as a power transmission dynamometer has been perfected to my personal knowledge more than twenty-five years, and if it were also a water wheel governor it would have been in use many years ago. As a matter of fact it is not a water-wheel governor, or a steam engine governor, or any other kind of a governor. It is a device for measuring the amount of power transmitted between a wa-

ter-wheel, for instance, and a generator, or between two shafts, one of which would be driven by a belt, and the other shaft absorbing the power, and its failure as a governor would have no effect upon my mind whatsoever, because I know from its construction that it is not a water-wheel governor or any other kind of a governor for constant speed.

XQ. 821. (By MR. WESTALL:) Now, you have stated in the device illustrated in Defendant's Exhibit Berry Blueprint 1, that you find no returning device. Do mean that there is no means intended, or no mechanisms contained or comprised within the device referred to, intended to prevent the governor from overrunning?

A. That is what I mean.

XQ. 822. So that your understanding is that in the construction last referred to in my last question, no provision or attempt of any kind by any of the mechanisms or arrangements therein, was made to prevent the overrunning you have described, or the effect of such overrunning?

A. No, sir, there is no provision made, and no provision to overcome the effects.

XQ. 823. So that you understand that if the device operated as it was intended to operate—for instance, referring to "Defendant's Exhibit Berry Blueprint No. 1"—that these overrunning effects would be present, and would prevent its successful operation?

A. There is no doubt about it; that is unquestionably the fact, even if the power transmission dynamometer had been replaced by proper governing mechanism to maintain constant speed.

XQ. 824. Referring specifically to the different

parts of the mechanism illustrated in the exhibit last referred to, will you please explain fully how the device would operate, assuming that it operated as was intended to permit this overrunning?

A. The device would operate in the following manner; if it were to operate as it was assumed to operate: a change of speed would cause a pull or a thrust in rod 17 connected to bell crank 19, which bell crank is connected by link 20 to straight bar 20, which would actuate a piston rod 23 leading to a valve 24. The movement of this valve would admit, in this particular case, water pressure to either one side or the other of piston 26 in cylinder 25, which, through connecting rod 27 and cross-head 29, would actuate, through a lever arm 31, the water gates, and through crank 49 the by-pass valve. Now, the by-pass valve and the water gate being both operated as a result of the motion of the connecting rod 40 and the crank 31, which moves the water gate, and the crank 49, which moves the by-pass valve, being both connected to this rod, will both be moving at the same time. Therefore, there is absolutely no provision whatsoever for the operation of what might be called a returning device, because when once set, the water gate valve must be moved if the by-pass valve is moved, and vice versa; and wherever this is the case, seesawing or hunting, or pumping, or fluctuation of speed above and below normal is absolutely unperventable.

XQ. 825. When you stated in referring to Complainant's Exhibit X, Lombard Governor Company Folder, that the use of a plug-cock valve with such a governor would be impracticable, or would not be successfully operated, you had reference, did you not, to a plug-cock

valve in which there was friction between the valve body and its casing, and not to a valve in which the body or plug is supported on a shaft or trunnion out of contact with its casing, had you not?

A. No, I have not distinguished as to whether the plug-cock was supported in one way or the other, but I did refer to a plug-cock valve in a pipe-line carrying water under heavy pressure, and, of course, not to small devices such as used in many minor mechanisms.

XQ. 826. To what extent if at all at the present time, are butterfly valves used with Lombard governors such as illustrated in Complainant's Exhibit KKK, or in Complainant's Exhibit X, Lombard Company Illustrated Folder?

A. They are used very extensively in low-head plants, but for high head plants the more satisfactory type of frictionless valve known as the needle valve is used.

XQ. 827. Can you mention any plant in which such butterfly valve is used in connection with a governor such as illustrated in Complainant's Exhibit KKK and in connection with a by-pass?

A. Great Western Power Company at Big Bend; the Drum plant of the Pacific Gas and Electric Company on the South Yuba River; the Electro plant of the Pacific Gas and Electric Company; Washington Power Company, Spokane River.

XQ. 828. In all the various water power plants that you have mentioned is this butterfly valve controlled by a Lombard governor such as illustrated in Complainant's Exhibit KKK?

A. Yes, sir.

XQ. 829. And is it used in a by-pass?

A. Yes, sir.

XQ. 830. And is that by-pass operated inversely to the main water wheel gate?

A. Yes, as a result of change of speed.

XQ. 831. You have spoken of the butterfly valve as being what is commonly called balanced, because, as I believe you stated, no matter what the difference in pressure on the two sides of the valve, there is no change in the amount of power to change its position. Referring now to Complainant's Exhibit Wilson Sketch A, I will ask you if it is not a fact that when the needle valve is closed it requires more power to open it than when it is partly opened?

A. Yes, sir, slightly.

XQ. 832. As a matter of fact, the entire pressure of the water back of the bulbous end of the needle shown in Complainant's Exhibit Wilson Sketch A, must be overcome before the needle can be moved backward?

A. No, sir, it must not. If the diameter of the rod leading to the bulbous and that you speak of is exactly equal to the diameter of the opening, the pressure would be equalized, of course, upon all sides of the needle nozzle itself; and the area exposed under any conditions to the difference in pressure is very small.

XQ. 833. In other words, if the diameter of the needle shaft—if that is the correct word—would prevent part of the pressure at the back of the bulbous end of the needle? Is that what you mean?

A. I would not say that it would prevent the pressure; but no matter what would be the pressure on the inside of a closed needle valve, the summation, or the to-

talling of all those pressures would be equalized, except that which is represented by the diameter of the nozzle.

XQ. 834. By "equalized" you mean to say that it would press equally on different parts of the rear portion of this bulbous nozzle?

A. No, I mean it would be equalized in all directions so that the net pressure would be zero. It is exactly as if we should take a baseball and throw it into a tank, the pressure on all the sides of that baseball would be such as not particularly to tend to crush it. It would be equal and opposite in all directions, as we say.

XQ. 835. Supposing, still using the baseball as an example, we take out the needle and substitute a baseball in the end, being held in position by the pressure of the water at its rear; before the baseball could be moved from its position as a stopper or plug of the end of the nozzle, all the pressure of the water behind it would have to be overcome, would it not?

A. No.

XQ. 836. Momentarily, at least?

A. No.

XQ. 837. Will you please explain why it would not?

A. The only pressure operating upon the needle would be due to the difference in area of the nozzle opening and the rod which carries the needle valve itself, which difference in area is very small, if not absolutely zero, as these needle nozzles are constructed.

XQ. 838. Answer the question. Will you please explain why it would not?

A. If we had a baseball at the end of the nozzle, the pressure upon the baseball would be due to the area of

the baseball represented by the area of the circle of the nozzle opening only.

XQ. 839. The pressure in the nozzle behind a spherical body located at the opening of the nozzle would operate upon such spherical body to hold it in position to a greater extent than if it had a shaft behind it, would it not?

A. Yes, sir, it would.

XQ. 840. That would be caused by the greater area upon which the pressure could act to hold the spherical body in its opening at the nozzle?

A. Yes, sir, the pressure per square inch, of course, would be exactly the same. The net area would be somewhat greater in the case of the baseball than if we should take a spherical body like a baseball and mount it upon a shaft, the diameter of this shaft being approximately equal to the diameter of the nozzle.

XQ. 841. So that it is a fact that when the needle nozzle is completely closed, to open such needle nozzle requires more power to move than it does when the needle of the nozzle is widely opened? Is not that true?

A. It is not true, because we balance that by means of a spring in the nozzle so as to make it absolutely balanced.

XQ. 842. But it is necessary to compensate for that extra power by use of this spring, is it not?

A. It is desirable to compensate for the extra pressure by the use of the spring.

XQ. 843. Is it true that the pressure on the opposite wings of a butterfly valve varies with its different positions assumed in moving full open to full closed positions?

A. The net pressure does not vary at all, no matter whether it is full open or full closed, because the pressure on one side is equalized by the pressure on the other side.

XQ. 844. Will you please explain why, no matter what the difference in pressure upon two sides of a butterfly valve is, there is no change in the amount of power to change the position of the valve?

A. Simply because, in changing the position of the valve you rotate one-half of the valve in the direction of the pressure, and you rotate the other half of the valve against the direction of the valve, and these two neutralize or equalize exactly.

XQ. 845. In the case of a needle nozzle illustrated in Complainant's Exhibit Wilson Sketch A, it is true, is it not, that the pressure of the water back of the bulbous end of the needle is exerted equally at all points back of said needle?

A. If the needle valve is absolutely closed, yes.

XQ. 846. Whether the valve is in open or closed position?

A. No, when the valve is open the needle part is drawn back within the water itself, so that there is a tendency to equalize the pressure in all directions then. In practise it may be said that in the operation of needle nozzles as constructed, there is no friction to be overcome as a result of the pressure within the pipe line, or in the vicinity of the nozzle.

XQ. 847. Isn't it a fact that in the needle nozzle illustrated in Complainant's Exhibit Wilson Sketch A, the water pressure exerted back of the bulbous head of the needle tends to press and hold the needle upon its

seat, and thus keep the valve closed, where, with a butterfly valve the full pressure of the water does not tend to keep the valve upon its seat, but that it can be moved as readily from full closed position as it can from half open to full open position?

A. Yes, I suppose it is true that there is a greater pressure upon the bulbous end of the needle nozzle when it is closed, unless it is neutralized, as we do, or compensated by a spring to equalize it, which is very readily and very satisfactorily done wherever it is required.

XQ. 848. You have likened the surrounding case of the by-pass valve of the device of this Berry Blueprint No. 1, to a brake-shoe, and the pressure of the water to the power pressing the shoe against the rotating part. In making this comparison you had in mind only, did you not, a plug-cock type of valve in which the body portion was not kept at all times out of contact with its casing by being adapted to rotate upon a shaft, or trunnions, had you not?

A. Yes, I had, but I wish to again state definitely that nobody ever saw a plug-cock type of valve which would hold water, that did not touch the casing; it must come in contact in order to be a valve in the proper sense of that word.

XQ. 849. Have you not stated previously upon your cross-examination that you had actually seen a plug-cock type of valve of approximately the same large comparative dimensions supported by a shaft or trunnion and so proportioned as not to come in contact with its casing?

MR. BLAKESLEE: Objected to as assuming a purely arbitrary construction which is not before us in this

case, and as not proper cross-examination, and indefinite, because no measure of the size of the plug-cock valve is defined.

A. I do not remember having so testified at all.

XQ. 850. (By Mr. Westall:) If you did make such statement do you wish now to say that you have never seen such a valve, that is to say a plug-cock type of valve, in which the body portion is so proportioned that it does not come in contact with its casing, but rotates upon, or is supported by a shaft or trunnion?

Mr. Blakeslee: Objected to as containing a negation in its very statement, inasmuch as the witness has testified that such a valve would not be a plug-cock valve.

A. I have never seen such a plug-cock type of valve, unless the plug-cock was taken out of the casing. I don't see how it would be possible to have the plug-cock in its casing without touching the casing, and yet be an operative valve.

XQ. 851. (By Mr. Westall:) Have you seen any form of valve so constructed?

A. I have seen a butterfly valve so constructed that it did not touch the interior of the pipe except the projections, as I have testified, corresponding to the seat of the valve.

XQ. 852. In comparing the needle type of valve with the butterfly valve you have testified that said valves have the following characteristics in common, namely, that the degree of opening of the valve may at any time change, whether from the position of being entirely closed to the position of being entirely open, without necessitating the overcoming of any friction between the moving parts of the valves and the surrounding case. It is true,

is it not, that a plug-cock valve in which the cylindrical body portion rotates, and is supported by a shaft or trunnions out of contact with its casing, also has the same common characteristics with the butterfly valve and the needle valve?

Mr. Blakeslee: The same objection, and further that it has already been answered, inasmuch as the witness has testified that such supposed plug-cock valve construction would not be a plug-cock valve.

A. If a plug-cock valve were constructed so that the outer surface of the cylindrical plug-cock did not come into contact with the casing of the valve, it would not be an operating valve at all, because it would not be tight; the amount of water going through the valve would not vary in proportion to the amount that the plug-cock was rotated.

XQ. 853. (By Mr. Westall:) Suppose that notwithstanding this supposed lack of practicability, it were so constructed, would it not have, in common with the needle valve and the butterfly valve, the characteristics described in the preceding question?

Mr. Blakeslee: The same objection, as merely argumentative.

A. I can only answer that by saying there is absolutely no possibility of any friction between two surfaces that do not touch one **another**.

XQ. 854. (By Mr. Westall:) And that therefore it would have the characteristics quoted in the question?

Mr. Blakeslee: The same objection.

A. It would have the characteristics, but it would not be a valve at all; it would simply be two parts that would not operate under any conditions as a valve.

XQ. 855. (By Mr. Westall:) You have stated upon your direct examination that the disclosures in the London patent set forth very clearly that the normal position of the by-pass valve may be anything which is desired by the operator to conform to operating conditions. Will you please refer to the patent and point out specifically where any such statement is made?

A. Quoting from the specifications in the patent, line 28, page 1, I find these words: "I provide a by-pass inserted into the penstock or flume at a point near the water gate and a gate in the said by-pass controlled by the the same governing mechanism that controls the water gate and operating to allow a greater or less flow through the by-pass, according as the water gate is being closed or opened."

Again, line 74, page 4: "It is obvious that the by-pass, arranged as described, opening or closing in a manner opposite to that in which the main gate opens or closes will, if properly adjusted, admit of the main gate being rapidly operated and the governing of the water wheel quickly accomplished. After the governing takes place the by-pass gate is either opened or closed, or nearly so, and in order to be useful for a second governing, must return to its normal position."

Again, beginning with line 99, page 4: "When the governing is completed, the controlling-solenoid allows the lever 26 to return to normal position, the circuit of the compensating magnet is broken by the return of rod 36 and lever 43, and the butterfly valve," which is the by-pass valve, "returns slowly under the influence of its weight 70 to normal position."

Again, line 35, page 4: "Normally the gate or valve

“in the by-pass will be half-way open, so that the amount
“of water flowing through the by-pass and around the
“wheel without doing work will be half the amount which
“the by-pass is capable of carrying.”

While that statement is made in the specifications, it is well known to those experienced in the art of governing water wheels, where the fluctuation of load is very slight, and the saving of water is important, that it is perfectly satisfactory to normally operate the by-pass valve even in a closed position, or nearly so. On the other hand, where the fluctuation of load, which causes the fluctuation of speed, is excessive and sudden and very frequent, the normal position of the by-pass valve would be partially open, so as to get the very best results of governing for constant speed and bringing the speed of the water wheel to normal as quickly as possible, with the least elapse of time.

XQ. 856. Suppose that the device of “Complainant’s Exhibit A” (Lyndon patent in suit) were so adjusted that normally the by-pass valve would be closed, and an increase of load were placed upon the water-wheel; please describe how the device of said Lyndon patent would operate?

A. It would not operate at all, inasmuch as the water wheel then would be taking absolutely all the water it possibly could get. If the load should be increased, the governing mechanism would be called upon to operate beyond its possible limitations.

XQ. 857. Still referring to the conditions described in the immediately preceding question, if an increase of load were thrown on the water wheel, it would have the

effect of decreasing the speed of the water wheel, would it not?

A. Yes, sir.

XQ. 858. And there would be no means, under the conditions outlined in the immediately preceding questions, for providing for that decrease of speed of the water-wheel?

A. There would be no means to increase the speed of the water wheel, because the governor is merely to control the amount of water delivered to the wheel, and if all the water available is being delivered to the wheel, the governor ^{now} ~~now~~ has acted up to its possible limitations. ▲ governor cannot be expected to produce more water per wheel.

XQ. 859. Then the device of said Lyndon patent in suit would not ordinarily be adjusted so as to have the by-pass valve completely closed under normal conditions?

A. Not ordinarily, but I have in mind a specific and definite water wheel and generator in Alaska which is operating so that under no circumstances shall it deliver to exceed 300 kilowatts; and in that case the governor is so operated that when the load exceeds 300 kilowatts the speed of the generator is allowed to drop, and that is the specific object of the governor in that case. That is not ordinary, however; that is a specific use of this governor. Nevertheless, the normal position of that governor when the load approaches 300 kilowatts is that the by-pass valve is closed; that, of course, is for the purpose of absolutely limiting the output of that particular water wheel and generator to 300 kilowatts.

